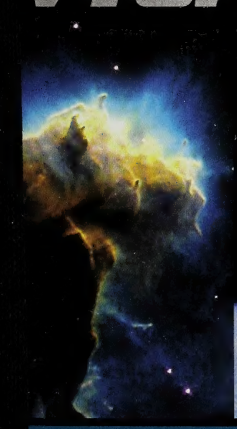
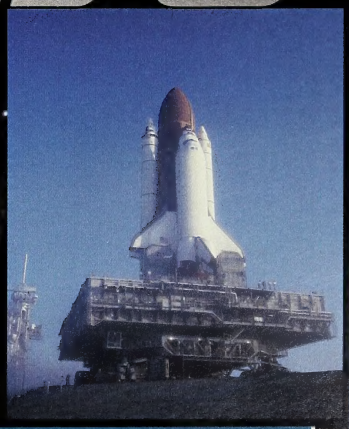
AL2.8603-334
c.2
University of Alberta Library
0 1620 3452356 1

Module 4

Mathematics 6





Fractions, Ratio, and Percent

Learning Technologies Branch

Alberta LEARNING

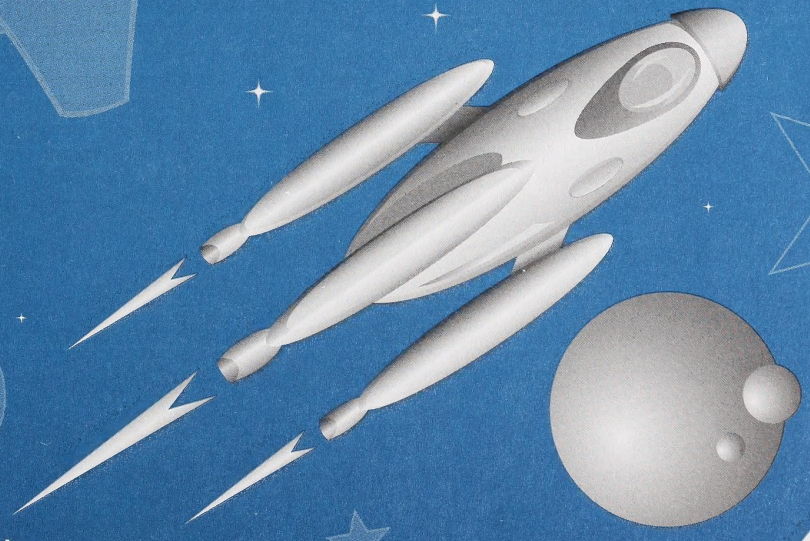
Digitized by the Internet Archive
in 2016 with funding from
University of Alberta Libraries

https://archive.org/details/mathematics604albe

Mathematics 6

Module 4

Fractions, Ratio, and Percent



Learning Technologies Branch

Alberta LEARNING

Mathematics 6
Module 4: Fractions, Ratio, and Percent
Student Module Booklet
Learning Technologies Branch
ISBN 0-7741-2225-0

The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Student Module Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

You may find the following Internet sites useful:

- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

ALL RIGHTS RESERVED

Copyright © 2002, the Crown in Right of Alberta, as represented by the Minister of Learning, Alberta Learning, 10155 – 102 Street, Edmonton, Alberta T5J 4L5. All rights reserved. Additional copies may be obtained from the Learning Resources Centre.

No part of this courseware may be reproduced in any form, including photocopying (unless otherwise indicated), without the written permission of Alberta Learning.

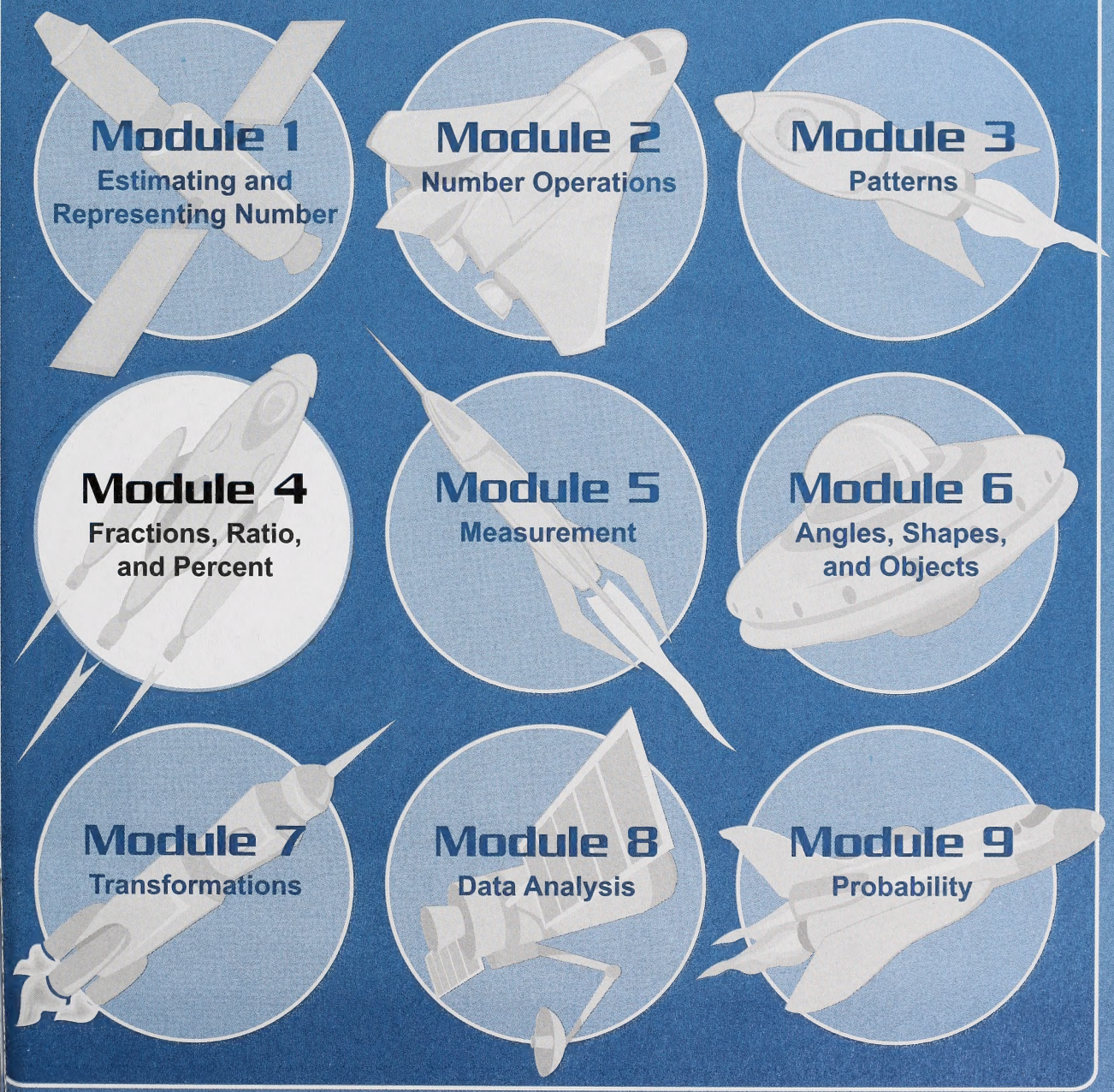
Every effort has been made both to provide proper acknowledgement of the original source and to comply with copyright law. If cases are identified where this effort has been unsuccessful, please notify Alberta Learning so that appropriate corrective action can be taken.

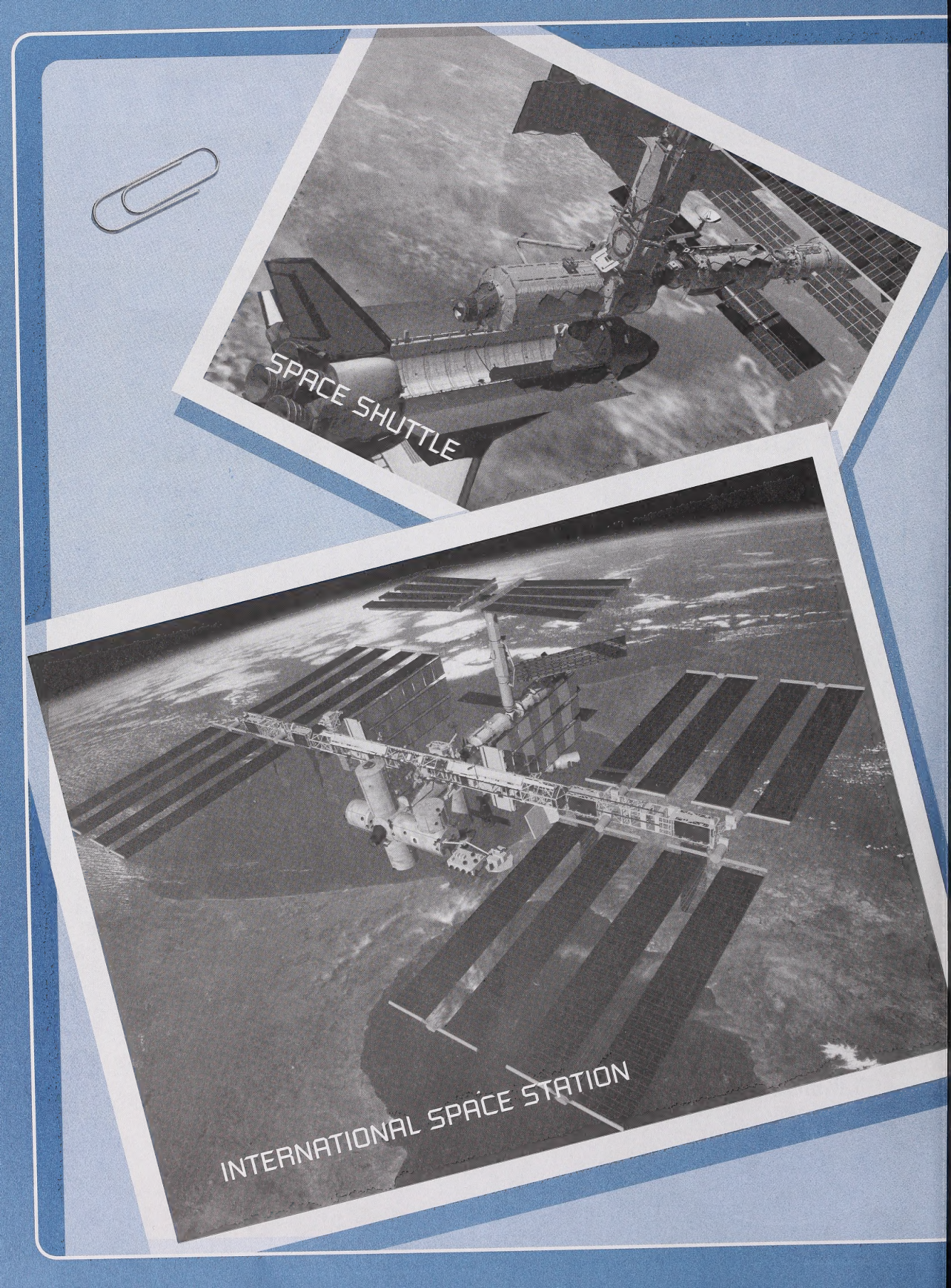
IT IS STRICTLY PROHIBITED TO COPY ANY PART OF THESE MATERIALS UNDER THE TERMS OF A LICENCE FROM A COLLECTIVE OR A LICENSING BODY.

UNIVERSITY LIBRARY
UNIVERSITY OF ALBERTA

Welcome to Mathematics 6

Mathematics 6 contains nine modules.
You should work through the modules in order (from 1 to 9) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.




SPACE SHUTTLE
INTERNATIONAL SPACE STATION

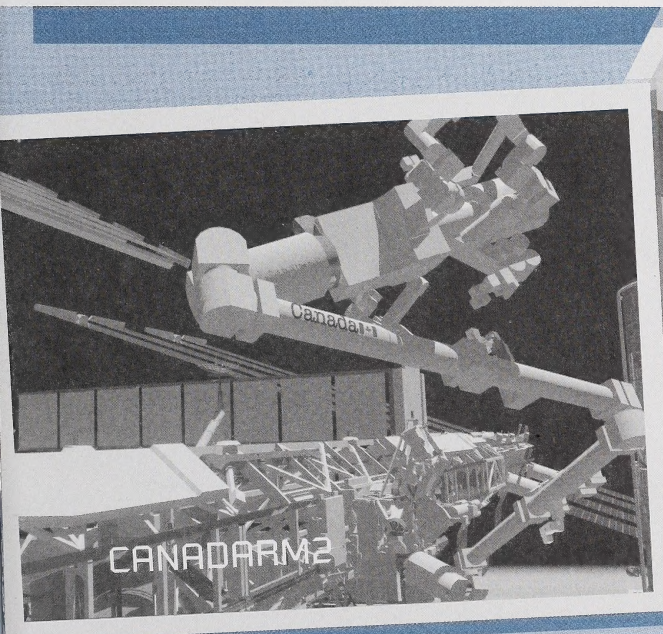
Adventures in Outer Space

Matthew: Wow, what a wonderful experience it was meeting Colonel Chris Hadfield at the Odyssium! He gave a presentation here in Edmonton on July 9, 2001, and talked about his adventures in space, including his mission aboard the Space Shuttle *Endeavor* to attach Canadarm2 to the International Space Station.

It's too bad you missed it, Kylee. You were away visiting your grandmother in Slave Lake.

Kylee: My trip was great, but I sure wish I could have heard Colonel Hadfield talk about being the first Canadian to walk in space. But I've got great news for you, Matthew! Commander Claire from the International Space Station is coming to town, and you and I will be spending some time with her.

I can't wait to hear about her adventures in space!



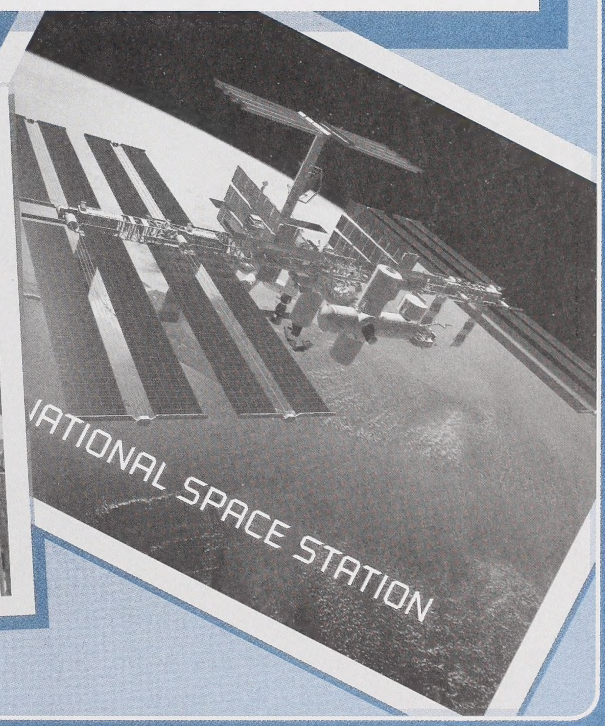


Table of Contents

Course Features 8

Assessment and Feedback 10

Module Overview 11

Numbers in the News 13

Lesson 1: Improper Fractions and Mixed Numbers 14
- Activity 1 15
- Activity 2 24
- Activity 3 30
- Challenge Activity 36
- Conclusion 37
- *Lesson 1 Assignment* 37

Lesson 2: Ratios 38
- Activity 1 39
- Activity 2 46
- Activity 3 49
- Challenge Activity 52
- Conclusion 53
- *Lesson 2 Assignment* 53

Lesson 3: Percent 54
- Activity 1 55
- Activity 2 61
- Activity 3 66
- Challenge Activity 70
- Conclusion 71
- *Lesson 3 Assignment* 71

Module Summary 72
Numbers in the News Project 72

Keystrokes 73

Review 78

Just the Facts 82

Mental Math 83

Appendix
Glossary 86
Answer Key 86
Image Credits 140
Learning Aids 141

Course Features

Take the time to look through the Student Module Booklets and the Assignment Booklets and notice the following design features:

- Each module has a Module Overview, Module Summary, and Review.
- Each module has several lessons. Each lesson focuses on a big idea that is central to the topic being learned in the module.
- Each lesson has several activities. An activity in each lesson is related to the Adventures in Outer Space theme.
- Each module has a Glossary and an Answer Key in the Appendix. In several modules there are also special pull-out pages in the Appendix.
- Each module has special exercises that focus on certain mathematical skills. The Numbers in the News project involves a scavenger hunt for samples of math in everyday life. The Keystrokes exercise introduces some "funky features" of the calculator that can be used to explore and practise important number ideas. Just the Facts gives you the opportunity to practise your basic number facts by doing a timed drill with your home instructor. The Mental Math exercise introduces an estimation skill or mental-computation strategy that you can use to sharpen your mental math skills.
- Each module references the Mathematics 6 Companion CD that includes additional material for review and mastery.

Required Resources

There are no spaces provided in the Student Module Booklets for your answers. This means you will need a binder and loose-leaf paper or a notebook to do your work.

In order to complete the course, you will need a copy of the Mathematics 6 textbook, *Quest 2000: Exploring Mathematics*, *Grade 6*, the soft-cover book *Quest 2000: Exploring Mathematics: Practice and Homework Book*, *Grade 6*, a basic four-operation calculator (such as the TI-108 calculator), and various manipulatives (base ten blocks and pattern blocks).

If you wish to complete the optional computer activities, you must have access to a computer that is connected to the Internet.

You will also need access to a computer to view material on the Mathematics 6 Companion CD.

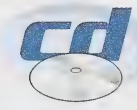
Visual Cues

For your convenience, the most important mathematical rules and definitions are highlighted. Icons are also used as visual cues. Each icon tells you to do something.

Use your calculator.

Use the Internet.

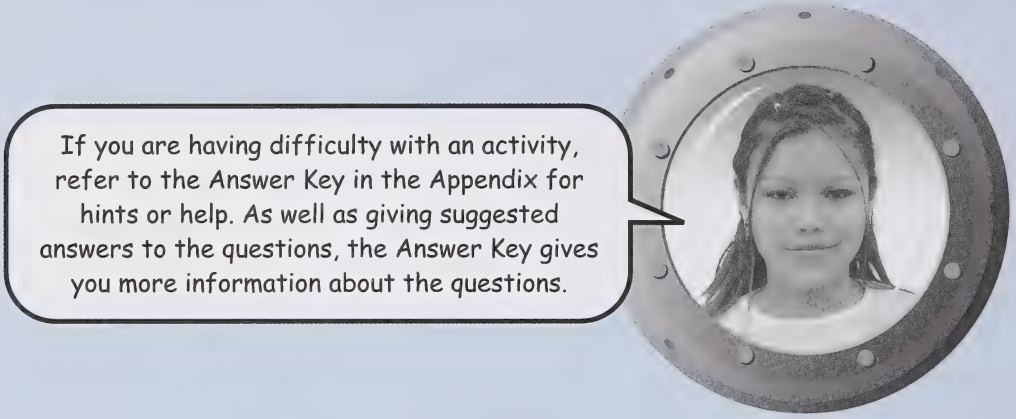
Refer to the textbook or the Practice and Homework Book.



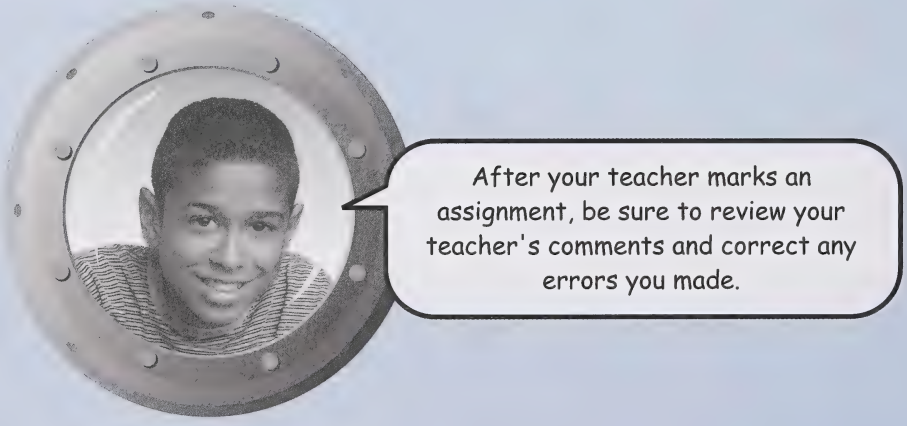
Use the Mathematics 6 Companion CD.

Assessment and Feedback

The Mathematics 6 course is carefully designed to give you many opportunities to discover how well you are doing. In every activity you will be asked to turn to the Appendix to check your answers. Completing the activities and comparing your answers to the suggested answers in the Appendix will help you better understand math concepts, develop math skills, and improve your ability to communicate mathematically and solve problems.


If you are having difficulty with an activity, refer to the Answer Key in the Appendix for hints or help. As well as giving suggested answers to the questions, the Answer Key gives you more information about the questions.

Twice in each module you will be asked to give your teacher your completed assignments to mark. Your teacher will give you feedback on how you are doing.



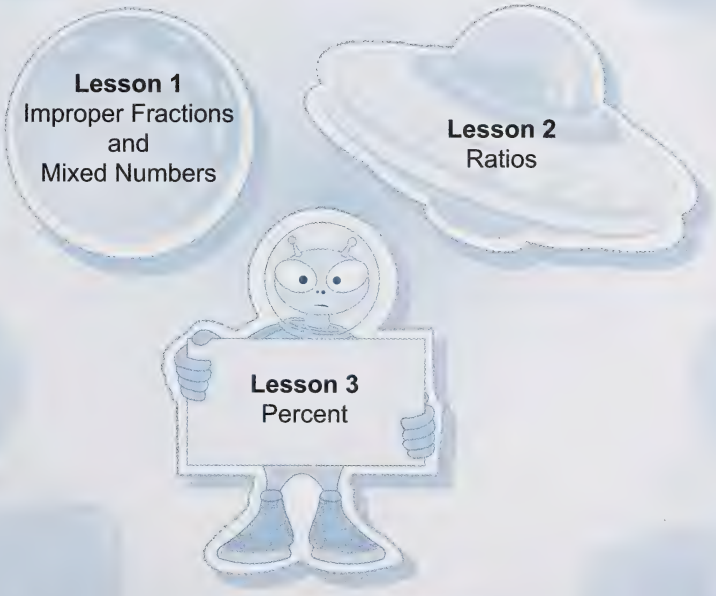
There will be a final test at the end of the course. You can prepare for the final test by completing the Review at the end of each module.

Module Overview

Mars has captured the imaginations of people for generations. Evidence of water erosion on its surface indicates that, millions of years ago, Mars was a warmer and more hospitable place. Perhaps life evolved on Mars and is waiting just below the surface to be re-awakened!

How does Mars compare to Earth? Mars is midway between the moon and Earth in size. Its diameter is just a little more than one-half of Earth's diameter, and its force of gravity is only 38% of Earth's force of gravity. The atmosphere of Mars consists mainly of carbon dioxide (95%) and nitrogen (3%). On Earth, the atmosphere is mostly nitrogen (77%) and oxygen (21%), and it exerts 125 times more pressure at the surface than the Martian atmosphere. The day on Mars is about 24.6 h long, just 2.5% longer than Earth's, but the Martian year is almost 687 days, which is 88% longer than Earth's year.

It is virtually impossible to compare Earth and Mars without using fractions, ratios, and percents. In Module 4 you will extend your knowledge of fractions to include improper fractions, you will explore ratios and their applications in daily life, and you will investigate percent.



Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The mark distribution is as follows:

Assignment Booklet 4A

Lesson 1 Assignment	30 marks
Lesson 2 Assignment	30 marks

Assignment Booklet 4B

Lesson 3 Assignment	30 marks
Numbers in the News	10 marks
Total	100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 4A to your teacher before you begin Lesson 3. You will submit Assignment Booklet 4B to your teacher at the end of this module.

Numbers in the News

Read through the following list before you begin Module 4. Begin by collecting samples of the ideas you already understand; others you may collect as you learn about them in the module. The samples you collect will depend on the newspapers or magazines you use.

Scavenger Hunt

Cut out articles or advertisements from newspapers or magazines that show fractions, ratios, and percents being used in different situations. Here are some suggestions of things to look for:

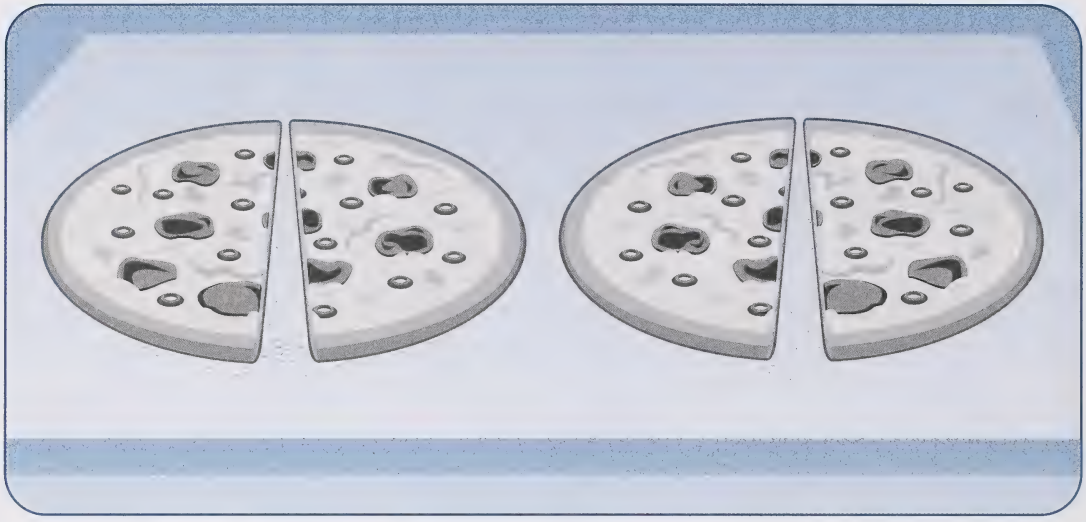
- improper fractions and mixed numbers (e.g., recipes, measurements)

- ratios used in different situations:
  - pictures of objects that show ratios
  - ratios written with symbols

- percents used in different situations:
  - percents that represent part of a whole (e.g., sale prices)
  - percents that represent part of a set of objects (e.g., percent of a group of people)

You will find further instructions for completing and submitting your project in Assignment Booklet 4B.

Improper Fractions and Mixed Numbers



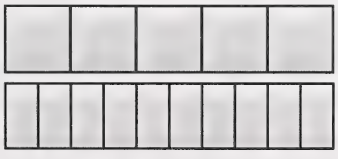
Michael and his sister, Ana, are sharing two small pizzas for a snack. Michael microwaved the pizzas and cut them into halves. Ana ate one piece, or one-half of one of the pizzas. Michael ate the other three pieces. Do you agree that Michael ate three-halves or one-and-a-half pizzas?

The fraction three-halves and the number one-and-a-half are examples of **improper fractions** and **mixed numbers**. In this lesson you will extend your understanding of fractions to include fractions like these. You will solve a variety of problems involving improper fractions and mixed numbers.

Activity 1

Today you will explore improper fractions and mixed numbers and learn how to convert improper fractions to mixed numbers.

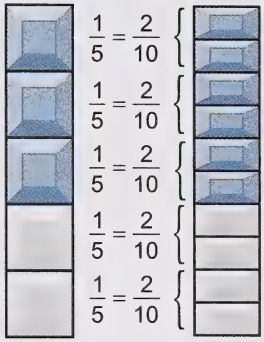
Part of Commander Claire's job is to do experiments to test the effects of new types of soil nutrients on plants grown in outer space. One nutrient is packaged in rectangular bars of equal size. Each bar is made to be snapped apart into a different number of equal pieces.



The partial bars used in experiments can be represented by fractions.

- The **denominator** is the number of equal pieces in one whole bar.
- The **numerator** is the number of equal pieces being used.

The diagram shows a five-piece bar (with five large equal pieces) and a ten-piece bar (with ten small equal pieces).



The shaded parts of the bars show that $\frac{3}{5} = \frac{6}{10}$ of each bar is being used in an experiment. The unshaded parts of the bars show that $\frac{2}{5} = \frac{4}{10}$ of each bar is left for the next experiment.

A five-piece bar can be used to condition the soil for five large plants. (Each of its pieces is $\frac{1}{5}$ of the bar.) A ten-piece bar can be used to condition the soil for either ten small plants (using ten separate pieces) or five large plants (using five groups of two pieces each). In a ten piece bar, each group of two pieces is $\frac{2}{10} = \frac{1}{5}$ of the bar.

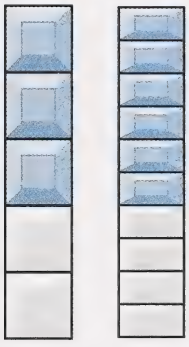
Remember, **equivalent fractions** represent the same amount.

In Module 3 you learned about common factors and the greatest common factor (GCF) of numbers.

If a numerator and denominator have common factors, you can use the GCF to find an equivalent fraction with the least denominator. Both numerator and denominator are divided by the GCF. This is called **simplifying** the fraction.

Example

In the diagram, the shaded parts show that $\frac{6}{10}$ of each nutrient bar is being used. The GCF of 6 and 10 is 2, so $\frac{6\div2}{10\div2}=\frac{3}{5}$.



The unshaded parts show that $\frac{4}{10}$ of each bar is left over. The GCF of 4 and 10 is 2, so $\frac{4\div2}{10\div2}=\frac{2}{5}$.

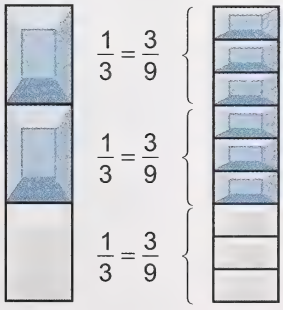
Example

Another kind of nutrient bar has nine pieces per bar. Six pieces are going to be used. Find a simpler fraction than $\frac{6}{9}$ to describe the part to be used.

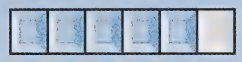
The GCF of 6 and 9 is 3.

$$\frac{6}{9}=\frac{6\div3}{9\div3}$$
$$=\frac{2}{3}$$

Therefore, $\frac{6}{9}=\frac{2}{3}$.

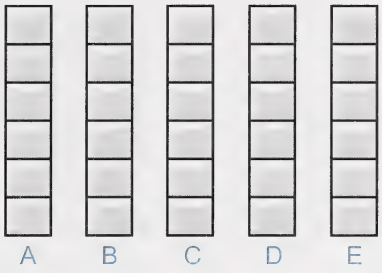


1. Copy and complete the following table in your notebook. (**Hint:** Write each fraction by using the total number of pieces in each nutrient bar as its denominator. Simplify fractions wherever possible.

Nutrient Bar	Fraction of Bar Used	Fraction of Bar Left Over
	$\frac{2}{4}=\frac{1}{2}$	
		$\frac{1}{6}$

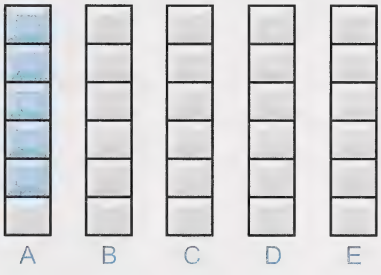
Check your answers on page 86 in the Appendix.

Commander Claire is doing a research project with plants in five different soil samples. She has only five nutrient bars to use (labelled A to E), all with six pieces each.

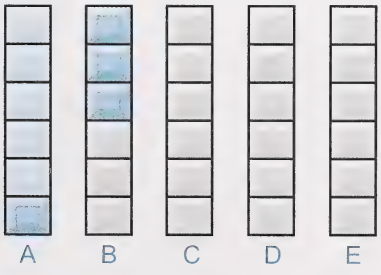


She works with the soil samples one at a time. Some soil samples need only part of a nutrient bar, some need a whole bar, and some need more than a whole bar. Parts of a bar that are not used in one soil sample are kept and used with the next soil sample before a new nutrient bar is opened.

Claire used five pieces from Bar A with the first soil sample.



For her second soil sample, Claire needed four pieces. She took the last piece of Bar A and three pieces from Bar B.



For the first two soil samples, Claire used a total of nine pieces of soil nutrient. Each piece is $\frac{1}{6}$ of a bar, so she has used $\frac{9}{6}$ of a bar so far. You can see that the nine pieces she used are $\frac{6}{6}$, or one whole bar (Bar A), plus $\frac{3}{6} = \frac{1}{2}$ of Bar B.

- $\frac{9}{6} = 1\frac{3}{6} = 1\frac{1}{2}$ bars
- $\frac{9}{6}$ is an **improper fraction**.
- $1\frac{3}{6}$ and $1\frac{1}{2}$ are **mixed numbers**.

An improper fraction is a fraction whose numerator is greater than its denominator. A mixed number is a whole number plus a proper fraction.

In an improper fraction, the numerator tells you how many parts you are using. The denominator tells you how many parts are needed to make one whole. If you divide the numerator by the denominator, you get a mixed number.

Example

Write $\frac{9}{6}$ as a mixed number.

$$\frac{9}{6} = 9 \div 6$$
$$= 1 \text{ R}3$$
$$= 1\frac{3}{6}$$
$$= 1\frac{1}{2}$$

$$6\overline{)9}\quad 1$$
$$\underline{6}$$
$$3$$

$$\frac{3}{6} = \frac{3 \div 3}{6 \div 3}$$
$$= \frac{1}{2}$$

Example

Write $\frac{18}{15}$ as a mixed number.

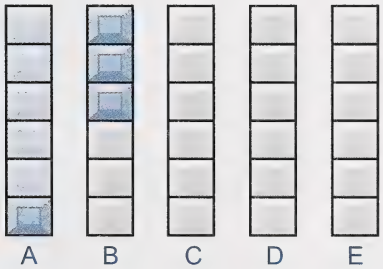
$$\frac{18}{15} = 18 \div 15$$
$$= 1 \text{ R}3$$
$$= 1\frac{3}{15}$$
$$= 1\frac{1}{5}$$

$$15\overline{)18}\quad 1$$
$$\underline{15}$$
$$3$$

$$\frac{3}{15} = \frac{3 \div 3}{15 \div 3}$$
$$= \frac{1}{5}$$

2. For her third soil sample, Claire used seven pieces of nutrient bar.

a. Copy the following diagram in your notebook. Use a red pencil crayon to shade the 7 pieces that Claire used for her third soil sample.



b. Write the total number of bars used for the first three soil samples as an improper fraction and as a mixed number. Simplify the fraction if possible.

3. For her fourth soil sample, Claire needed $\frac{5}{6}$ of a bar of soil nutrient.

   a. On your diagram for question 2.a., use a green pencil crayon to shade the pieces that Claire used with her fourth soil sample.

   b. Write the total number of bars used in the first four experiments as an improper fraction and as a mixed number. Simplify the fraction if possible.

4. For her fifth soil sample, Claire needed $\frac{4}{3}$ bars of soil nutrient.

   a. Write the fraction $\frac{4}{3}$ an equivalent fraction with a denominator of 6.

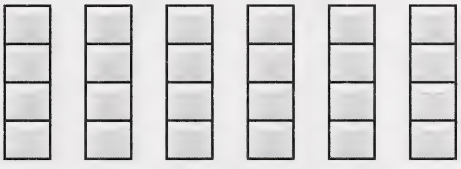
   b. On your diagram for question 2.a., use an orange pencil crayon to shade the pieces that Claire used with her fifth soil sample.

   c. Write the total number of bars used in the soil nutrient research project as an improper fraction and as a mixed number. Simplify the fraction if possible.

   d. How much soil nutrient was left over when the project was completed? Write the remaining amount as a fraction of a bar of soil nutrient.

Check your answers on pages 87 and 88 in the Appendix.

5. Another research project studied the growth of tree saplings with a different type of soil nutrient. The following diagram shows the six nutrient bars for saplings (labelled A to F). Each whole bar is made to be snapped apart into four equal pieces.



Use the diagram to help you complete the following table. Write each answer in the last row of the table as a proper or improper fraction and as a whole number or mixed number. Simplify the fractions if possible.

Soil Sample	**1**	**2**	**3**	**4**	**5**
Number of Pieces Used for That Soil Sample	3	5	6	5	3
Total Number of Pieces Used So Far	3	8			
Total Number of Bars Used So Far	$\frac{3}{4}$	$\frac{8}{4} = 2$			

Check your answers on page 88 in the Appendix.

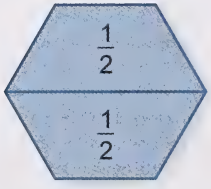
If you have access to the Internet, you can find more about the effects of weightlessness on plants at the following website:

http://www.nasa.gov

Activity 2

Today you will investigate changing mixed numbers to improper fractions.

The Northern Meadows community league is planning a fall festival. The social committee wants to seat people in groups of six for the dinner. The community hall has trapezoidal tables that can be put together to make hexagonal tables that will seat six people.



Each trapezoidal table is $\frac{1}{2}$ of a hexagonal table.

Two trapezoidal tables make $\frac{2}{2} = 1$ hexagonal table.

Use your pattern blocks to answer questions 1 to 8.

1. Five trapezoidal tables can be used to make $\frac{5}{2} = 2\frac{1}{2}$ hexagonal tables. Use your pattern blocks to model this. Draw a picture to show your work.

2. Use your pattern blocks to find how many hexagonal tables you can make with six trapezoidal tables.

   a. Draw a picture to show your work.

   b. Represent the number of hexagonal tables you can make with an improper fraction and then with a mixed number or a whole number.

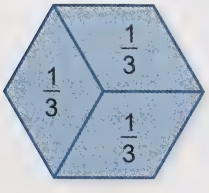
3. Copy and complete the following table in your notebook. Use your pattern blocks to help you.

Number of Trapezoidal Tables Used	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Number of Hexagonal Tables Made (fraction)	$\frac{2}{2}$	$\frac{3}{2}$					
Number of Hexagonal Tables Made (whole/ mixed number)	1	$1\frac{1}{2}$					

4. Would there ever be a time when you would have more than one trapezoidal left over when you use them to make hexagonal tables? Explain your thinking.

Check your answers on page 89 in the Appendix.

Suppose you have some rhombus-shaped tables, and each is one-third of a hexagonal table.



Each rhombus-shaped table is $\frac{1}{3}$ of a hexagonal table.

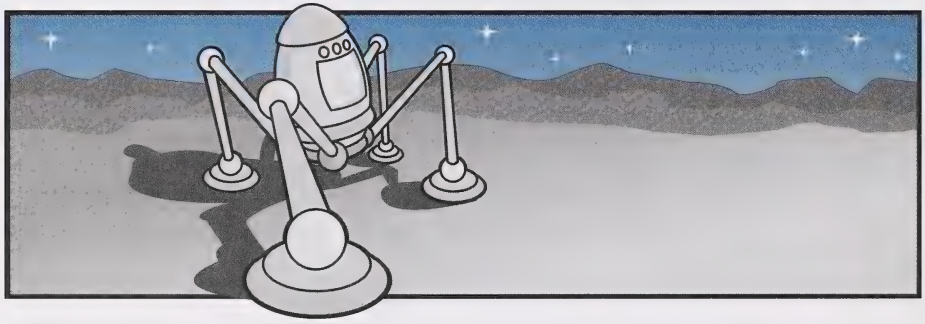
Three rhombus-shaped tables make $\frac{3}{3} = 1$ hexagonal table.

5. Copy and complete the following table in your notebook. Use your pattern blocks to help you.

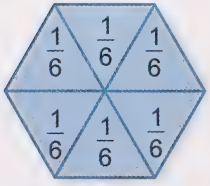
Number of Rhombus-Shaped Tables Used	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Number of Hexagonal Tables Made (fraction)	$\frac{3}{3}$							
Number of Hexagonal Tables Formed (whole/ mixed number)	1							

6. If you had a number of rhombus-shaped tables, how many could be left over if you used as many of them as possible to make hexagonal tables? Explain your thinking.

Check your answers on page 90 in the Appendix.



Suppose you have some triangular tables, and each is one-sixth of a hexagonal table.



Each triangular table is $\frac{1}{6}$ of a hexagonal table.

Six triangular tables make $\frac{6}{6} = 1$ hexagonal table.

7. Copy and complete the following table in your notebook. Use your pattern blocks to help you.

Number of Triangular Tables Used	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Number of Hexagonal Tables Made (fraction)	$\frac{6}{6}$							
Number of Hexagonal Tables Made (whole/ mixed number)	1							

8. If you had a number of triangular tables, how many could be left over if you used them to make hexagonal tables? Explain your thinking.

Check your answers on page 90 in the Appendix.

9. List all of the different shapes of small tables (trapezoidal, rhombus-shaped, or triangular) that could be used, without mixing them, to make each of the following larger hexagonal tables. Sketch one possible arrangement for each shape of small table.

   a. 7 hexagonal tables

   b. $3\frac{1}{2}$ hexagonal tables

   c. $4\frac{2}{3}$ hexagonal tables

10. List the equivalent improper fractions that represent your answers to questions 9.a., 9.b., and 9.c.

11. Look for a pattern when you compare mixed numbers with their equivalent improper fractions. What rule can you use with the whole number, denominator, and numerator of any mixed number to get the numerator and denominator of the equivalent improper fraction?

Check your answers on pages 91 and 92 in the Appendix.

In the previous questions, what method did you discover for converting mixed numbers to improper fractions? Was it the one shown in the following examples?

Example

Write $2\frac{3}{4}$ as an improper fraction.

Step 1

Multiply the whole number by the denominator of the fraction.

$$2 \times 4 = 8$$

Step 2

Add the numerator of the fraction to the number you obtained in Step 1.

$$8 + 3 = 11$$

Step 3

The answer to Step 2 is the numerator of the improper fraction. Write the improper fraction using this numerator and the denominator of the original fraction.

So, $2\frac{3}{4} = \frac{11}{4}$. ← From Step 2
← The denominator of the original fraction

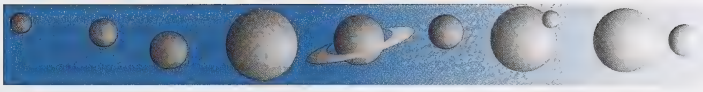
You can combine these steps as follows.

$$2\frac{3}{4} = \frac{(4 \times 2) + 3}{4}$$
$$= \frac{8 + 3}{4}$$
$$= \frac{11}{4}$$

Example

Write $5\frac{6}{7}$ as an improper fraction.

$$5\frac{6}{7} = \frac{(7\times 5)+6}{7}$$
$$= \frac{35+6}{7}$$
$$= \frac{41}{7}$$

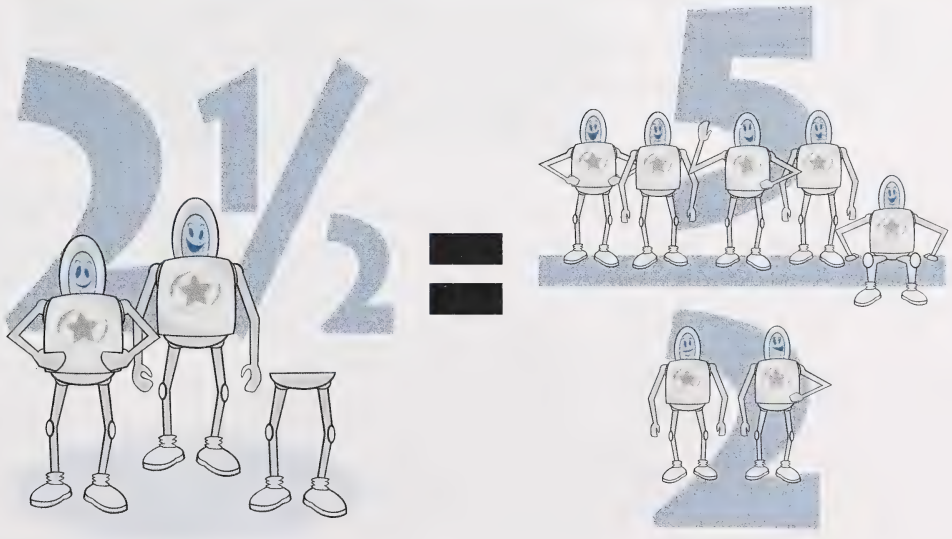


12. Write each of the following mixed numbers as an improper fraction.

a. $1\frac{3}{4}$ **b.** $2\frac{5}{8}$ **c.** $6\frac{3}{4}$

d. $9\frac{2}{3}$ **e.** $5\frac{1}{2}$ **f.** $11\frac{2}{3}$

Check your answers on page 92 in the Appendix.

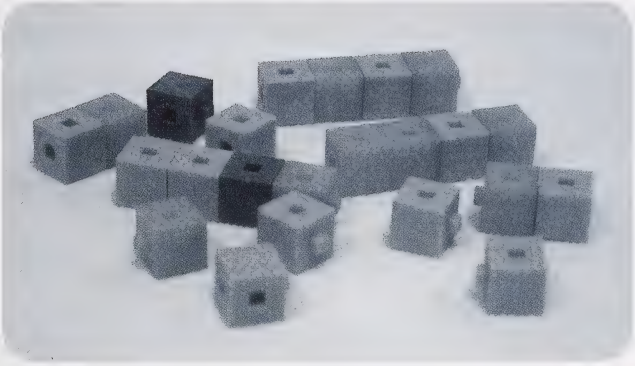


Activity 3

Today you will use mixed numbers and improper fractions to solve problems.

Ms. Moore bakes delicious cookies. She sells more cookies than anyone else at the County Fair, so she has to make multiple batches of her recipes. Because she bakes so often, she finds it handy to keep measuring scoops in all her containers of ingredients.

Use centicubes or counters to help you answer questions 1 to 6.



1. The recipe for one batch of oatmeal cookies calls for $1\frac{1}{2}$ cups of flour.

Ms. Moore keeps a $\frac{1}{2}$-cup scoop in her flour canister.

a. Using one centicube to represent each $\frac{1}{2}$-cup scoop, make a model that represents $1\frac{1}{2}$ cups of flour. Draw and label a picture to show your work.

b. Write an improper fraction that represents the $1\frac{1}{2}$ cups of flour Ms. Moore needs.

c. Ms. Moore wants to triple her recipe for oatmeal cookies. Use centicubes to represent the number of $\frac{1}{2}$-cup scoops of flour she will need. Draw a picture of your work and write the improper fraction that your picture shows.

d. Combine the centicubes you used for question 1.c. to make as many whole cups of flour as possible. Draw a picture of your work and write the whole number or mixed number that your picture shows.

2. The recipe for one batch of raisin cookies calls for $\frac{3}{4}$ of a cup of raisins. Ms. Moore keeps a $\frac{1}{4}$-cup scoop in her raisin jar.

   a. Ms. Moore wants to double her recipe for raisin cookies. Using one centicube for each $\frac{1}{4}$-cup scoop, make a model that represents the number of $\frac{1}{4}$-cup scoops of raisins she will need to double her recipe. Draw a picture of your work and write the improper fraction that your picture shows.

   b. Combine the centicubes you used for question 2.a. to make as many whole cups of raisins as possible. Draw a picture of your work and write the whole number or mixed number that your picture shows. Simplify the fraction if possible.

3. The recipe for one batch of coconut cookies calls for $\frac{2}{3}$ of a cup of sugar. Ms. Moore keeps a $\frac{1}{3}$-cup scoop in her sugar canister.

   a. Ms. Moore wants to triple her recipe for coconut cookies. Using one centicube for each $\frac{1}{3}$-cup scoop, make a model that represents the number of $\frac{1}{3}$-cup scoops of sugar she will need. Draw a picture of your work and write the improper fraction that your picture shows.

b. Combine the centicubes you used for question 3.a. to make as many whole cups of sugar as possible. Draw a picture of your work and write the whole number or mixed number that your picture shows.

Check your answers on pages 93 and 94 in the Appendix.

4. The recipe for one batch of chocolate chip cookies calls for $1\frac{1}{4}$ cups of chocolate chips. Ms. Moore keeps a $\frac{1}{4}$-cup scoop in her chocolate chip jar.

a. Chocolate chip cookies are the most popular, so Ms. Moore is going to make 5 times her usual recipe. Using one centicube for each $\frac{1}{4}$-cup scoop, make a model that represents the number of $\frac{1}{4}$-cup scoops of chocolate chips she will need. Draw a picture of your work and write the improper fraction that your picture shows.

b. Combine the centicubes you used for question 4.a. to make as many whole cups of chocolate chips as possible. Draw a picture of your work and write the whole number or mixed number that your picture shows.

5. Ms. Moore normally sells her raisin cookies for $4/dozen. Mr. Burns has 18 children coming to story time at the library and he wants to give each child one raisin cookie.

a. Use counters to represent the cookies Mr. Burns needs. Group them to show how the number of dozen cookies he needs can be represented by an improper fraction and as a mixed number. Draw and label a picture to show your work.

b. What is the total cost to buy the raisin cookies? Explain.

c. Ms. Moore decided to sell Mr. Burns the raisin cookies for $1/dozen. Show how you can write Mr. Burns' cost, in dollars, by using a mixed number and by using a decimal. Explain how these two ways of writing the cost are related.

Check your answers on pages 94 and 95 in the Appendix.

Question 6 is optional. Do question 6 if you had trouble with question 5 and you need more practice.

6. Ms. Moore sells her oatmeal cookies for $1.50/dozen. Ms. Tychkovski has 10 children in her summer day camp. She needs enough oatmeal cookies to put 3 in each child's bag lunch.

a. Use counters to represent the cookies Ms. Tychkovski needs. Group them to show how the number of cookies (in dozens) she needs can be represented by an improper fraction and as a mixed number. Draw and label a picture to show your work.

b. Ms. Tychkovski will be paying for the cookies with quarters. Use counters to represent the quarters Ms. Tychkovski needs to use. The number of quarter-dollars she needs can be represented by both an improper fraction and a mixed number. Group the counters to show these representations. Draw and label a picture to show your work.

c. Write the total cost of the oatmeal cookies in dollars and cents. Explain how this way of writing the cost is related to the improper fraction and mixed number you wrote in question 6.b.

7. Chloe was Ms. Moore's final customer and she bought all the cookies that were left: 6 oatmeal cookies, 8 raisin cookies, 4 coconut cookies, and one dozen chocolate chip cookies. Ms. Moore only had small boxes left that each held one half-dozen cookies. Draw and label a picture to show how the number of dozen cookies Chloe bought can be represented by a mixed number and an improper fraction.

Question 8 is optional. If you had trouble with question 7, do question 8 for more practice.

8. Use pattern blocks for the following question. Use one yellow hexagon to represent one dozen.

   Ezra placed an order to buy cookies for an upcoming family picnic: $\frac{1}{2}$ dozen coconut cookies, twice as many raisin cookies as coconut cookies, 3 times as many oatmeal cookies as raisin cookies, and half as many chocolate chip cookies as oatmeal cookies. How many half-dozens, dozens, and individual cookies did he order?

Check your answers on pages 96 and 97 in the Appendix.

Sharing Time

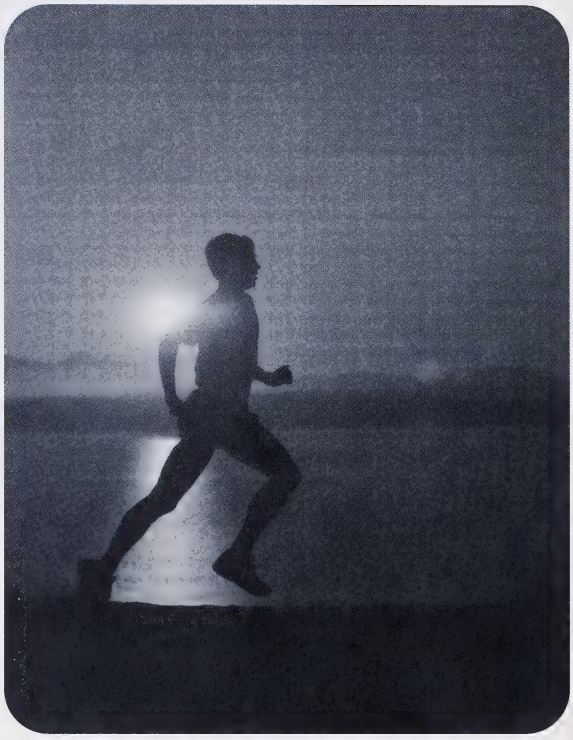
Now it's time to show your home instructor what you have been learning.

1. Write an example of a mixed number. Rewrite it as an improper fraction.

2. Write an example of an improper fraction. Rewrite it as a mixed number.

Discuss your answers with your home instructor.

Challenge Activity



Rahim has two routes that he follows on his daily run. One route goes through the river valley. The other route goes through Rahim's neighbourhood.

Use the page of paper rods from the Appendix to answer the following questions. Draw diagrams to explain your answers.

1. The river-valley route is longer than the route through Rahim's neighbourhood. In fact, he must complete his neighbourhood route 3 times to go as far as when he runs the river-valley route twice. If you let a dark green rod represent the length of the river-valley trail, what colour of rod represents the length of the route through his neighbourhood? Explain.

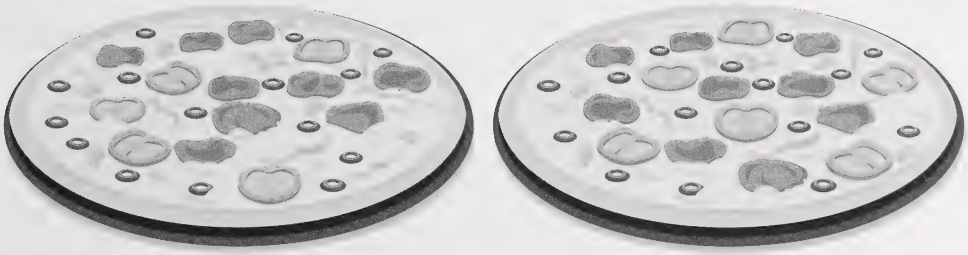
2. Rahim runs at the same rate of speed all the time. If it takes him 2 h to complete the river valley trail, what colour of rod would you use to represent the distance Rahim runs in 1? Explain.

3. If it takes Rahim 2 h to complete the river valley trail, how long does it take him to complete his neighbourhood route? Explain.

Check your answers on pages 97 and 98 in the Appendix.

Conclusion

In this lesson you extended your knowledge of fractions to include improper fractions and mixed numbers. You learned how to convert from one form to the other and how to use fractions in everyday problem-solving situations.



Marty and seven of his friends bought two large pizzas. They cut each pizza into six equal pieces. After each boy had one piece of pizza, Marty said there was still two-thirds of a pizza left. Is Marty right? How much did the boys eat and how much remains?

Turn to Assignment Booklet 4A and complete the Lesson 1 Assignment.

Keep Assignment Booklet 4A until you have completed the entire booklet.

Ratios

For every three hockey cards, I have two baseball cards.
Four out of five sports cards in my collection are hockey cards.
Wow, and your collection is twice the size of mine!

Have you ever rented a movie that said it was in letterbox format? If you have, you likely watched a movie with black bars above and below the picture. Would you like to be able to explain this to your parents? It's all about ratios.

The screen in one local theatre is about 11 m wide and 6 m tall. If a television screen were made 6 m tall, it would be about 8 m wide. Fitting the same movie on the television as on the theatre screen just doesn't work. Two solutions are used. The first chops off the sides of the picture. The hope is that you won't miss them. The other is letterbox format, which shows the entire picture, but leaves part of the screen black.

These are examples of how ratios are used in daily life. In this lesson you will discover how to represent ratios and use them to solve problems.

Activity 1

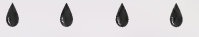
Today you will investigate ratios.

Housekeeping duties are a routine part of life in space.

NASA

Did you ever think that if you became an astronaut and went to space that you wouldn't have to worry about taking out the garbage? Well, guess again! It's one of the jobs that must be done regularly at the space station! In fact, it is a very organized task.

The trash that built up or accumulated at the space station after one, two, three, and four days is shown in the following table.

Number of Days	1	2	3	4
Number of Bags of Wet Trash Accumulated				
Number of Bags of Dry Trash Accumulated				

The table shows that as the mission continued, three more bags of trash accumulated each day: one bag of wet trash and two bags of dry trash. The ratio of the number of bags of wet trash to the number of bags of dry trash can be written as 1 to 2 or 1:2 or $\frac{1}{2}$.

The symbol (:) is used to represent the word *to* in a ratio.

A **ratio** is a comparison of quantities.

1. **a.** How is the number of bags of wet trash accumulated related to the number of days?

   b. How is the number of bags of dry trash accumulated related to the number of days?

2. **a.** Use your answers to question 1 to copy and complete the following table in your notebook.

Number of Days	1	2	3	4	5	6	7	8	9	10
Number of Bags of Wet Trash Accumulated	1									
Number of Bags of Dry Trash Accumulated	2									
Total Number of Bags of Trash Accumulated	3									

b. How is the total number of bags of trash accumulated related to the number of days?

c. What is the ratio of the number of bags of wet trash accumulated to the total number of bags of trash? Write your answer in two different ways.

d. What is the ratio of the number of bags of dry trash accumulated to the total number of bags of trash? Write your answer in two different ways.

Check your answers on pages 98 and 99 in the Appendix.

3. Another mission with a larger crew produced more trash. Each day, two bags of wet trash accumulated. Each day, the number of bags of wet trash accumulated compared to the number of bags of dry trash was in a 2:3 ratio.

a. Copy and complete the following table in your notebook by drawing pictures to show the ratios.

Number of Days	1	2	3	4
Number of Bags of Wet Trash Accumulated				
Number of Bags of Dry Trash Accumulated				

b. How is the number of bags of wet trash accumulated related to the number of days?

c. How is the number of bags of dry trash accumulated related to the number of days?

4. **a.** Use your answers to question 3 to copy and complete the following table in your notebook.

Number of Days	1	2	3	4	5	6	7	8	9	10
Number of Bags of Wet Trash Accumulated										
Number of Bags of Dry Trash Accumulated										
Total Number of Bags of Trash Accumulated										

b. How is the total number of bags of trash accumulated related to the number of days?

c. What does the ratio 2:5 describe?

d. What does the ratio 3:5 describe?

Check your answers on pages 99 and 100 in the Appendix.

A duty roster that repeated for each of the five weeks of one mission is shown in the following table. Use the table to answer questions 5 to 7.

Duty	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Trash	Claire	Chris	Claire	Chris	Claire	Chris	Claire
Laundry	Steve	Claire	Steve	Claire	Steve	Claire	Julie
Supplies Check	Chris	Evan	Evan	Evan	Evan	Evan	Steve
Food	Julie	Julie	Chris	Julie	Julie	Julie	Evan
Safety Check	Evan	Steve	Julie	Steve	Chris	Steve	Chris

5. Write each of the following ratios in two ways.

   a. the ratio of the number of days Claire was on trash duty compared to the number of days she was on laundry duty

   b. the ratio of the number of days Chris was on safety check duty compared to the number of days Steve was on safety check duty

   c. the ratio of the number of days Evan was on supplies check duty compared to the number of days Steve was on supplies check duty

   d. the ratio of the number of days Julie was on food duty compared to the number of days in the weekly rotation

6. The ratio 1 to 3 compares the number of days one of the astronauts was on supplies check duty compared to the number of days the same astronaut was on trash duty. Identify the astronaut.

7. The ratio 3 to 5 compares the number of days Claire was on a particular duty to the number of days someone was on food duty in the weekly rotation. Identify the duty and the person that the ratio compares Claire to.

Check your answers on page 100 in the Appendix.

NASA

Questions 8 to 10 are optional. Do these questions if you need more practice.

The following table shows the number of hours each day that astronauts are awake and asleep while in space. Use the table to answer questions 8 to 10.

Number of Days	1	2	3
Total Hours of Sleep	8	16	24
Total Hours Awake	16	32	48

8. a. How is the total number of hours an astronaut has scheduled for sleep on a mission related to the total number of days the mission lasts?

b. How is the total number of hours an astronaut has scheduled for being awake on a mission related to the total number of days the mission lasts?

c. How is the total length of time an astronaut has scheduled for sleep on a mission related to the total length of time the mission lasts?

9. Write each of the following ratios in two ways.

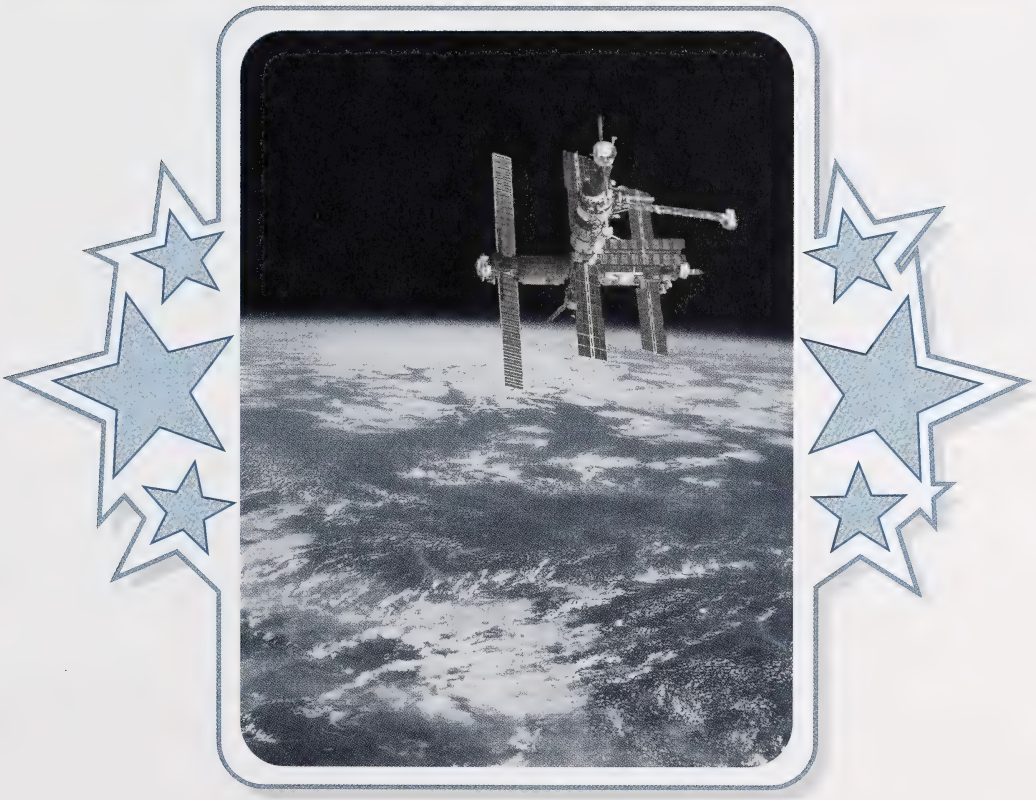
a. the ratio of the number of hours an astronaut sleeps each day compared to the number of hours an astronaut is awake each day

b. the ratio of the number of hours an astronaut sleeps each day compared to the number of hours in a day

c. the ratio of the number of hours an astronaut is awake each day compared to the number of hours in a day

10. Write the ratio of the total number of hours that an astronaut sleeps compared to the total number of hours an astronaut is awake during one week in space. Explain.

Check your answers on page 101 in the Appendix.



Activity 2

Today you will develop strategies for solving problems involving ratios.

Goran saw the following advertisement in his local newspaper.

SUPPORT THE ANIMAL SHELTER!

Solve the following problem and submit your entry with $10.
If your entry is drawn, and your answer is correct, you will win

$100.

We currently have 20 animals at the shelter and they are all cats and dogs.

- The ratio of cats to dogs is 3 to 2.
- The ratio of male cats to female cats is 5 to 1.
- The ratio of puppies to adult dogs is 1 to 3.

Of all the animals at the shelter, how many are male cats, how many are female cats, how many are adult dogs, and how many are puppies?

At first, Goran was baffled because the problem seemed very confusing, but his dad suggested that he use different colours of centicubes to model the ratios. Use some centicubes of your own and follow Goran's strategy by answering questions 1 to 5.

1. Are there more cats or more dogs at the shelter? Explain.

2. Choose one colour of centicube to represent the cats and a different colour to represent the dogs. Use centicubes to show how many dogs there would be if there were 3 cats.

   a. Draw and label a picture to show the group of centicubes you used.
   b. How many animals in all does your group of centicubes show?

3. **a.** Add more centicubes in the ratio of 3 to 2 (one group at a time) until you have the total number of animals (20) in the shelter. Draw and label a picture to show your work.

   b. How many separate groups of centicubes in the 3:2 ratio are in your picture?

   c. Count the centicubes to tell how many cats and how many dogs are in the shelter.

   d. Copy and complete the following table so that it shows the steps you used. (Remember, the ratio is 3:2.)

	Groups of Centicubes That Were Added	Total Number
Cats	□□□ +	
Dogs	□□ +	
Animals	5 +	

   e. Use the table you completed in question 3.d. to explain the steps of a paper-and-pencil method you could use to calculate the number of cats and dogs using the ratio and the total number of animals.

Check your answers on page 102 in the Appendix.

4. Find how many of the cats are male and how many are female by completing the following questions.

   a. Copy and complete the following table. (Remember, the ratio is 5:1.)

	Groups of Centicubes That Were Added	Total Number
Male Cats		
Female Cats		
Total Cats		

   b. Show a paper-and-pencil method to explain the steps.

5. Use either the table method or the paper-and-pencil method to find how many of the dogs are puppies. Show your work.

6. Goran won the contest and was invited to the shelter to see the animals. By the time he made his visit, two of the male cats had been adopted and there was one more puppy.

   a. What was the new ratio of cats to dogs? Explain.

   b. Write the new ratio that compares the number of male cats to the number of female cats, use centicubes to model it, and then explain how the numbers in the ratio are related to each other.

   c. Explain how you can model this new ratio of male cats to female cats using less centicubes than you used in question 7.b. How can you rewrite the ratio using smaller numbers?

d. Write the new ratio that compares the total number of puppies to the total number of adult dogs.

e. Rewrite the ratio from question 7.d. with smaller numbers that have the same meaning. Explain how it compares the number of adult dogs to puppies.

Check your answers on pages 103 and 104 in the Appendix.

Activity 3

Today you will solve a variety of problems using ratios.

Tiarra is preparing to dye Easter eggs with her sister, Laurenn. She bought a package that has one bottle each of red, blue, yellow, and green food colouring. Different colour blends are shown on the package, along with a guide that tells how many drops of each of the four colours you use to make one unit of each blended colour.

Use the table to answer questions 1 to 7.

Blended Colour	Orange	Turquoise	Mauve	Cherry
What to Use to Make One Unit of Blend	1 drop R 3 drops Y	4 drops B 1 drop G	3 drops R 1 drop B	2 drops R 3 drops Y
Total Number of Colour Drops in One Unit of Blend	4			
Centicube Model of One Unit of Blend	R Y Y Y			

1. Write a ratio that shows the number of drops of the different food colourings that are used to make one unit of each of the following blended colours.

   a. orange
   b. turquoise
   c. mauve
   d. cherry

2. Use centicubes to model each unit of blended colour. Copy and complete the table on the previous page by telling the total number of drops of colour in one unit of each of the blended colours and by drawing the centicubes that represent them.

Check your answers on pages 104 and 105 in the Appendix.

The ratios you wrote in question 2 are said to be in **lowest terms** because they tell you how to make one unit of blended colour, which is the least number of colour drops needed to make a particular colour blend. To get an exact match of the colours shown on the blending table, the package calls for 20 drops of food colouring to be used for every 125 mL of boiling water. Otherwise, the colour blends will turn out to be too dark or too light.

Use the centicube models you made in question 2 to answer questions 3 to 5.

3. Draw a picture and write a ratio that shows the 20 drops of food colouring Tiarra must add to 125 mL of boiling water for each blended colour. (**Hint:** Decide how many units of blended colour are needed to use 20 drops of food colouring.)

a. orange
b. turquoise
c. mauve
d. cherry

4. For each of the following blended colours and amounts of boiling water, write a ratio that shows the number of drops of each colour of food colouring Tiarra must add to the boiling water. Explain your reasoning.

a. Tiarra needs 250 mL of boiling water to dye the eggs turquoise.
b. Tiarra needs 500 mL of boiling water to dye the eggs mauve.
c. Tiarra needs 750 mL of boiling water to dye the eggs cherry.
d. Tiarra needs 1 L of boiling water to dye the eggs orange.

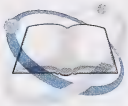
5. Laurenn wants a bluer shade of mauve than the chart suggests. To make one unit of blended colour, she uses the same number of red drops shown on the table but adds an extra drop of blue. How will that change the number of drops of each colour of food colouring needed with 125 mL of boiling water? (See question 3.c.)

6. Laurenn showed Tiarra the beautiful blended colour she discovered by mixing 24 drops of blue food colouring and 16 drops of yellow food colouring with 200 mL of boiling water. Tiarra wanted to make one unit of Laurenn's colour blend for herself. Write a ratio in lowest terms that shows the number of drops of each colour of food colouring Tiarra needs to make one unit of Laurenn's new colour.

Check your answers on pages 105 to 107 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.



Turn to page 42 of the Practice and Homework Book and complete question 1 and questions 5 to 8.

Discuss your answers with your home instructor.

Challenge Activity

David Chee used 15 scoops of paint to make a particular shade of green for the art instruction his mom is giving him and his two sisters. David used a ratio of 4 scoops of yellow for every 1 scoop of blue.

To answer the following questions, model the problem using two colours of counters. Draw diagrams to help explain your reasoning.

1. How many scoops of yellow paint and how many scoops of blue paint did David use to begin with?

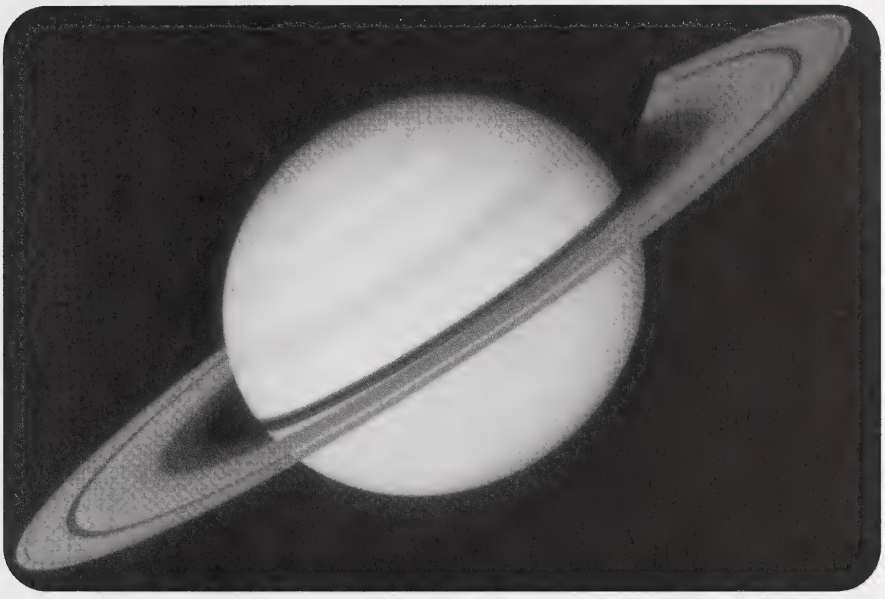
2. When she saw that the shade of paint David made was too light, his mom mixed in one more scoop of blue. Then the paint was shared equally by pouring it into four identical containers. What was the ratio of yellow paint to blue paint in each person's container?

3. Susan wants to paint with a darker shade of green. She plans to mix in exactly enough blue so her paint will be a mixture of equal amounts of yellow and blue. How many extra scoops of blue paint does Susan need to put into her container?

Check your answers on page 107 in the Appendix.

Conclusion

In this lesson you saw how ratios are used in daily life. You learned how to represent ratios and use them to solve problems.

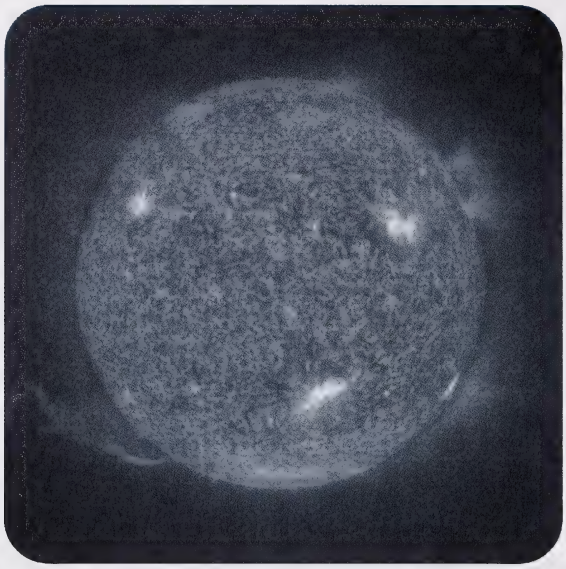


In our solar system, the distances the planets are from the sun are often expressed as ratios of their distances from the sun to the distance Earth lies from the sun. These ratios are called astronomical units (AU). The distance Saturn is from the sun is 9.54 AU. This means that Saturn is about 9.54 times farther from the sun than Earth is.

Turn to Assignment Booklet 4A and complete the Lesson 2 Assignment.

When you are done, submit Assignment Booklet 4A to your teacher to be marked.

Percent



NASA

The sun is an ordinary star of average size in the universe. It belongs to the 20% of stars that are single stars. The other 80% are twin stars or multiple-star systems. Have you ever thought what it would be like to see two suns rise in the sky?

The sun is a nuclear furnace in which hydrogen is fused into helium. The sun was formed 5 billion years ago in a cloud of gas, billions of years after the first stars began to burn in the Milky Way. Astronomers estimate that the sun is a middle-aged star, with about 50% of its lifetime yet to come. So, for how many years will the sun continue to shine just like it does today? To answer this question, you need to understand percent.

In this module you will discover that percent is a ratio that compares a number to 100. You will explore how percent is used in everyday life.

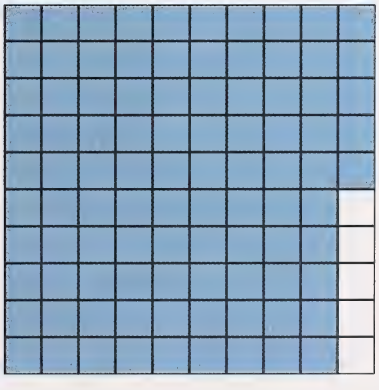
Activity 1

Today you will apply the definition of percent.

The view of Earth from the International Space Station, 400 km above the Earth, always gives me a deeper appreciation for our beautiful planet.
Name: Earth
Age: 4.6 billion years
Mass: 5 940 000 000 000 000 000 000 t
Surface Area: 510 000 000 km²
Population: 6 billion

The sun accounts for 95% of the mass of the solar system. This means that the sun accounts for 95 kg out of every 100 kg of mass that makes up the solar system.

One way to picture this is to use a diagram of a base ten flat to represent the mass of the solar system. The 95 shaded units represent the mass of the sun.



Percent means "out of 100" or "per hundred."

Imagine that Earth needed a passport to travel through the solar system! Such a passport might include a profile that would identify Earth by describing a number of unique features of the planet.

1. **a.** One prominent feature of Earth is its oceans, which cover 71% of its surface. If a diagram of a base ten flat represents the entire surface of Earth, how many units would you shade to show the area covered by the ocean?

   b. The area that remains unshaded represents the surface area of Earth that is covered by land. What percent of Earth is covered by land? Explain.

2. The percent of Earth's land covered by each of the seven continents is shown in the following table.

Continent	Percent of Earth's Land
Africa	20
Antarctica	10
Asia	30
Australia	5
Europe	7
North America	16
South America	12

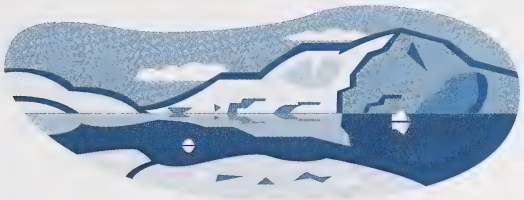
   a. Make seven sets of centicubes, using a different colour to represent the percent of Earth's land covered by each continent. Arrange the cubes in a square array. Tell what the dimensions of the array are, and what percent each square represents of the whole.

b. Using pencil crayons to match the colours of your centicubes, colour a grid to show the percent of Earth's land area covered by each of the seven continents. Be sure to include a legend to tell which colour stands for which continent. Use a 10-by-10 grid from the Appendix.

c. The area of the largest continent is how many times greater than the area of the smallest continent?

d. North America is about how many times greater in area than Europe? Explain.

e. Which continent's area is half of Africa's area?



3. The percent of Earth's population in each of the seven continents is shown in the following table.

Continent	Percent of Earth's Population
Africa	13
Antarctica	0
Asia	61
Australia	0.5
Europe	12
North America	8
South America	5.5

a. Find the total of the percents listed for the seven continents. Explain why it is that total.

b. Colour a 10-by-10 grid from the Appendix to show the percent of Earth's population in each continent. (Use the same colour key that you used for question 2.b.)

c. Does the continent with the greatest percent of Earth's land have the greatest percent of Earth's population? Explain.

d. Does the inhabited continent with the least percent of Earth's land have the least percent of Earth's population? Explain.

Check your answers on pages 108 and 109 in the Appendix.

4. Earth's chemical composition is shown in the following table.

Element (by mass)	Percent of Earth's Chemical Composition
Iron	35
Oxygen	30
Silicon	15
Magnesium	
Sulfur	2
Nickel	2
Other	3

Total: 100%

a. What percent of Earth's chemical composition is magnesium? Explain.

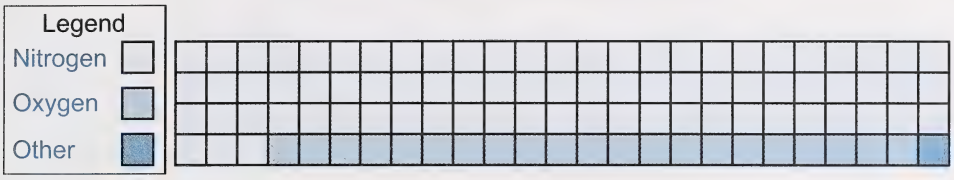
b. Why can a 20-by-5 grid be used to represent percents?

c. Using a different colour for each element, colour a 20-by-5 grid from the Appendix to show the percent each element is of Earth's chemical composition. Don't forget to include a legend to tell which colour stands for which element.

d. What is the most abundant element in Earth's chemical composition?

e. Which two elements together make up 50% of Earth's chemical composition? Explain.

5. The percents of the gases that make up Earth's atmosphere are shown in the 25-by-4 grid below.



a. Use the grid to copy and complete the following table in your notebook.

Atmospheric Gas	Percent of Earth's Atmosphere
Nitrogen	
Oxygen	
Other	

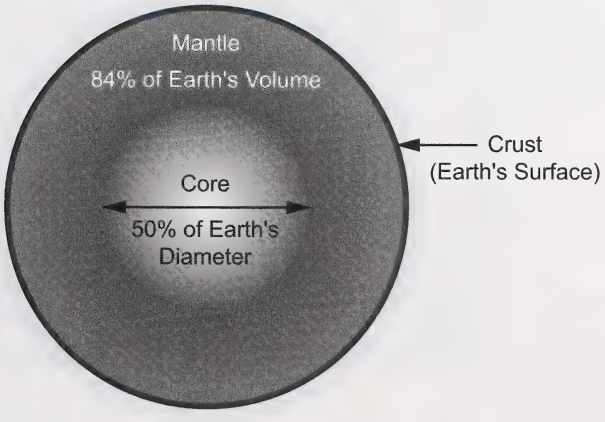
Total: _____%

b. The percent of nitrogen in the atmosphere is about how many times greater than the percent of oxygen? Explain.

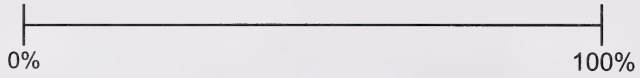
Questions 6 and 7 are optional. Do these questions if you want to find out more about the composition of Earth.

Earth is made up of three main layers: the crust, the mantle, and the core.

Cross Section of Earth



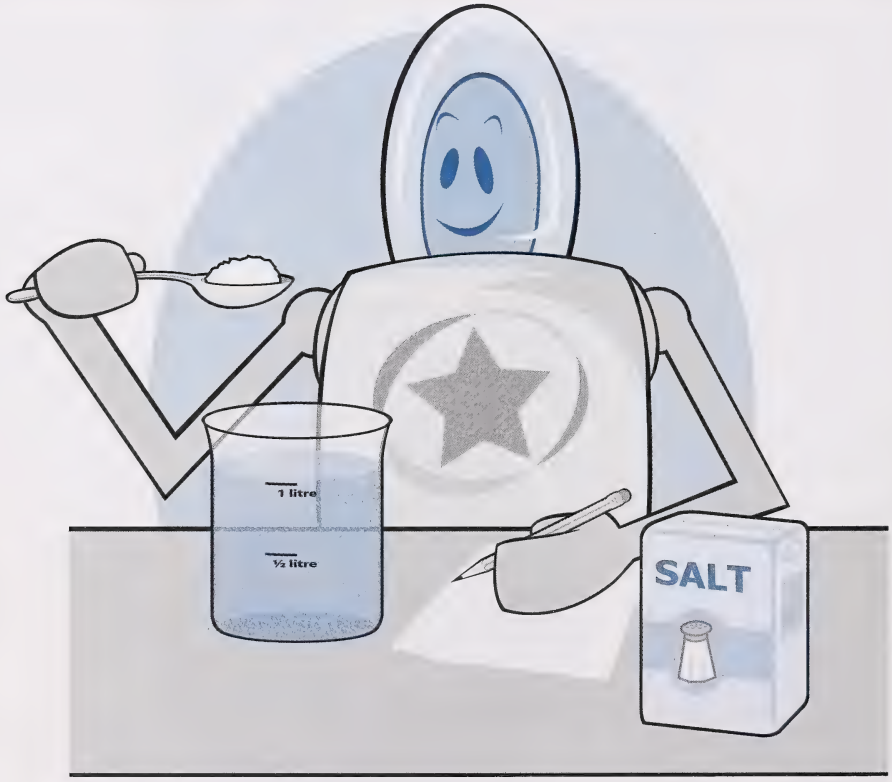
6. **a.** The following line segment represents 100% of Earth's diameter. Estimate, mark, and label the point that shows the percent that represents the diameter of the core.



b. Use a large base ten cube to represent 100% of Earth's volume. Draw a picture to show the least number of base ten flats and rods you would use to represent the volume of the mantle. Explain.

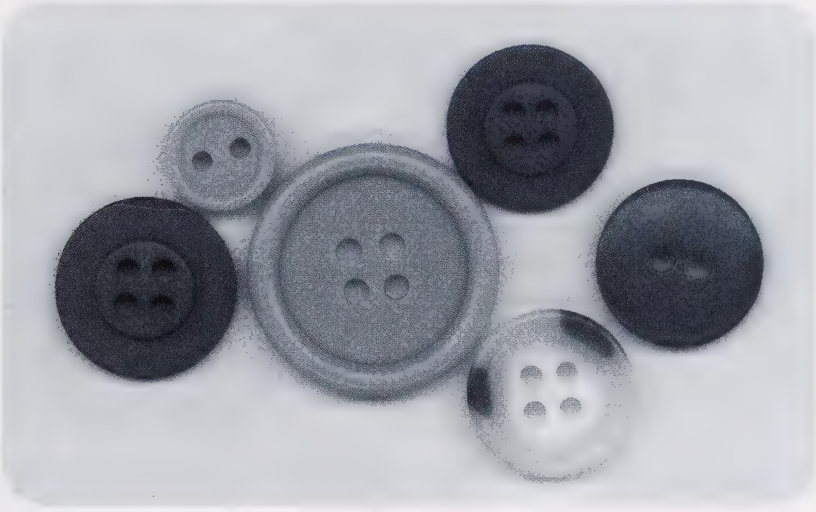
7. Of all the water that covers Earth, 97% is salt water and 3% is fresh water. If you used a 1-L container of water to represent all the water that covers Earth, how many millilitres would represent salt water and how many millilitres would represent fresh water? Explain.

Check your answers on pages 109 to 111 in the Appendix.



Activity 2

Today you will examine the relationship among fractions, decimals, and percents.



Haley's mom asked her to help with the mending. Haley has a "button box" that contains an assortment of buttons collected over many years. In fact, she even has some of her great-grandma's buttons!

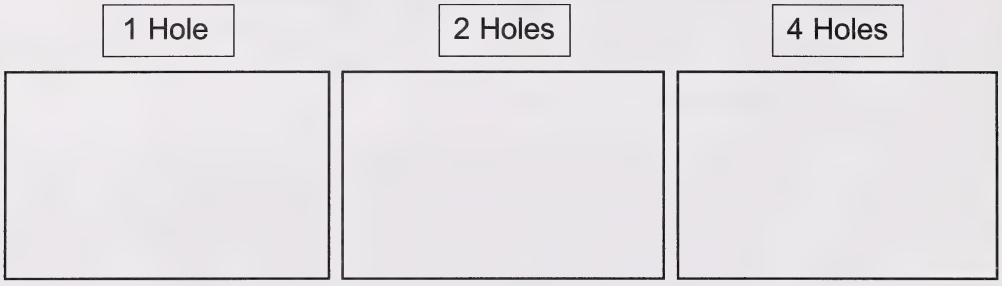
For this activity, you will need the sheet of buttons from the Appendix, some sheets of paper, and some small index cards. The buttons on the sheet are the buttons in Haley's "button box." Cut out the individual buttons.

1. Before she began mending, Haley sorted her buttons. First, she sorted them according to the number of holes they have. Haley used the following procedure to sort her buttons. Follow the procedure with your paper buttons.

    - Use one sheet of paper for each number of holes the buttons have: one hole, two holes, or four holes.

    - Label a separate index card for each number of holes.

- Arrange your sheets of paper and cards as shown.



- Sort the buttons. Arrange them on the sheets of paper in arrays so they will be easy to count.

2. a. How many buttons are in Haley's button box?

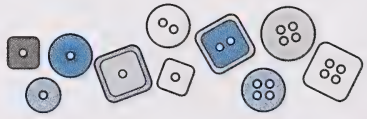
b. Write a common fraction and a decimal that tell what fraction each button is of all the buttons in the box.

c. Each button is what percent of all the buttons in the box?

d. Count the buttons in each set and copy and complete the following table in your notebook.

	Number of Buttons	**Percent of Buttons**
1 Hole		
2 Holes		
4 Holes		
	Total:	Total:

3. If Haley uses 5 of the one-hole buttons, 2 of the two-hole buttons, and 3 of the four-hole buttons to do some mending, what percent of her buttons would she use? What percent of the buttons would be left? Explain.

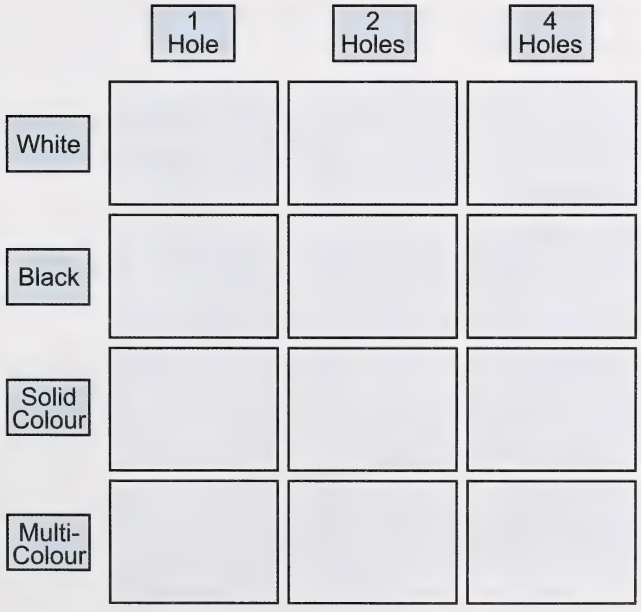


4. Using the original set of buttons from question 1, Haley wants to replace 6 four-hole buttons on her shirt with 6 of the two-hole buttons from her button box, and then add the 6 four-hole buttons she takes off her shirt to her button box. After she does this, what percent of her buttons will have one hole, what percent will have two holes, and what percent will have four holes? Explain.

Check your answers on pages 111 and 112 in the Appendix.

5. Before Haley began mending, she sorted her buttons according to colour. Follow Haley's procedure with your paper buttons.

   - Label an index card with each of the following colours: white, black, solid colour (not white or black), and multi-colour.
   - Add three rows of sheets of paper to your first row of buttons sorted according to the number of holes.
   - Arrange your sheets of paper and cards to make a Carroll diagram, as shown.



   a. Sort the buttons in each column according to their colours.

b. Count the buttons in each set. Copy and complete the following table in your notebook to show the percent of buttons for each cell in the table.

		Number of Holes			
		1 Hole	2 Holes	4 Holes	Total %
Colour	White				
	Black				
	Solid Colour				
	Multi-Colour				
	Total %				

6. Haley said you can use one button and add one button so that the percent of white buttons will be equal to the percent of solid colour buttons; and, together, the black and multi-colour buttons will be 30% of all the buttons. Which colour of button will she use and which colour of button will she add? Explain.

Question 7 is optional. Complete this question if you need more practice with the ideas in this activity.

7. After Haley sorted her buttons according to the number of holes and according to their colours, she sorted them further according to their shape.

a. Sort your paper buttons on each sheet into a set of round buttons and a set of square buttons.

b. Write a common fraction, a decimal, and a percent that tell what part of all the buttons in Haley's button box are round and what part are square.

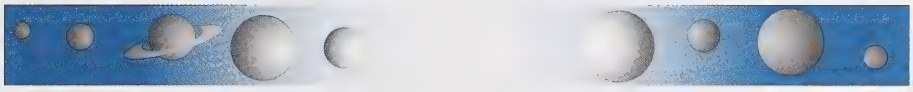
Check your answers on pages 113 to 116 in the Appendix.

- Every fraction can be written as a decimal and a percent.
- Every decimal can be written as a fraction and a percent.
- Every percent can be written as a fraction and a decimal.

This three-way relationship is shown as follows.

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \ldots = \frac{50}{100} = \frac{500}{1000} = \frac{5000}{10\,000} = \ldots$$

$$50\% = 0.5 = 0.50 = 0.500 = 0.5000 = \ldots$$

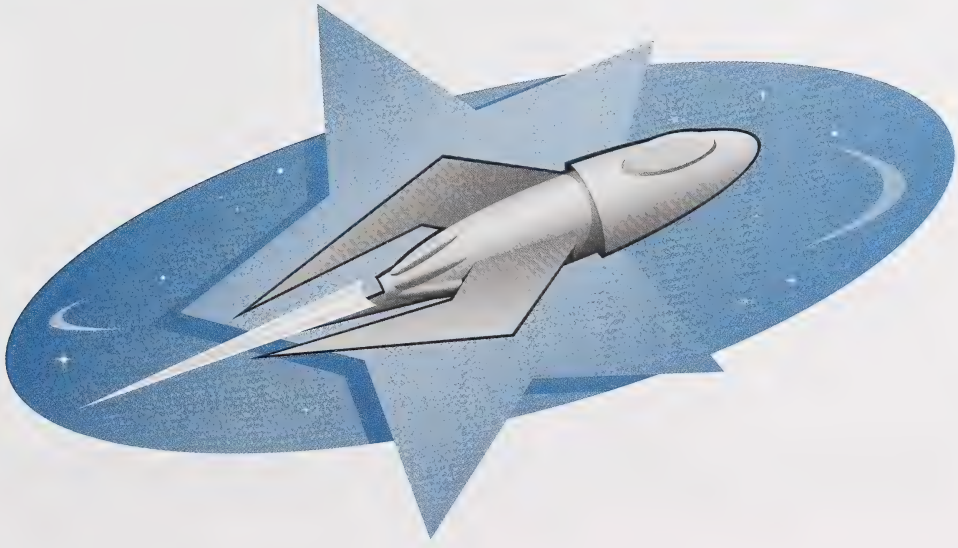


Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 46 of the Practice and Homework Book and complete questions 1 to 9.

Discuss your answers with your home instructor.



Activity 3

This activity is based on the Legends of Gold Dinner held at the Shaw Conference Centre in Edmonton during the Eighth World Championships in Athletics, August 6, 2001.

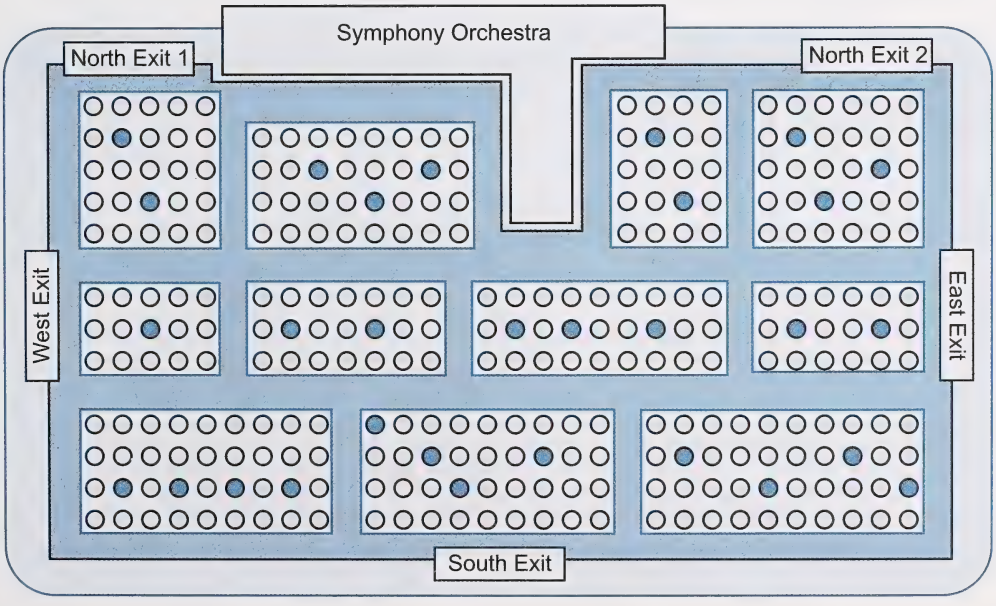
You have already learned the following about fractions and decimals:

- Every fraction has an infinite number of equivalent fractions.
- Every decimal has an infinite number of equivalent decimals.

In this activity you will explore the relationship among fractions, decimals, and percents.

COURTESY OF ECONOMIC DEVELOPMENT EDMONTON

A special athletic celebrity dinner to honour gold medal winners is being held at a conference centre. The following diagram shows the seating plan for 300 tables. (Each circle is a table.) Celebrities will be seated throughout the room, as shown by the shaded tables in the diagram. Before the banquet begins, the celebrities will walk from the west exit to the east exit as they are introduced and greeted by the audience. Use the diagram to answer questions 1 to 6.



1. How many tables are 1% of all the tables? Explain.

2. **a.** To describe the portion of the tables that have celebrities seated at them, write three equivalent common fractions: one fraction with the total number of tables as the denominator, one fraction with a denominator of 100, and one fraction with a denominator of 10.

   b. Write two equivalent decimals: one decimal that shows tenths and one decimal that shows hundredths.

   c. Write a percent.

Questions 3 to 5 are optional. Complete them if you feel you need more practice with the ideas in this activity after you have completed questions 6 to 10.

3. The banquet organizers want the guests at the banquet to have a good view of the athletes as they walk along the carpeted aisles. Write a common fraction with a denominator of 100, a decimal, and a percent that tells what portion of the tables are

   a. beside an aisle
   b. one table in from an aisle
   c. two tables in from an aisle

Check your answers on page 116 in the Appendix.

4. Write a common fraction with a denominator of 100, a decimal, and a percent that tells what portion of all the tables are located immediately beside (either due north, south, east, or west)

   a. at least one celebrity table
   b. two celebrity tables

5. Some of the tables beside an aisle have a celebrity table immediately beside them.

   a. Write a common fraction that tells what portion of the aisle tables have a celebrity table immediately beside them.

   b. Round your answer to question 5.a. to a fraction with a denominator of 100. Then, write your approximation as a decimal and a percent.

6. Each table seats 10 people. If 90% of the seats were sold the day before the banquet, how many seats were unsold? Show your work.

7. Fifty percent of the seats at half of the tables were reserved for the organizing committee and volunteers.

   a. How many seats were reserved for the organizing committee and volunteers? Explain.

   b. Write a common fraction, a decimal, and a percent that tells what fraction of all the seats were reserved for the organizing committee and volunteers.

8. A provincial dignitary and his or her guest were seated at each celebrity table to act as honourary hosts.

   a. What percent of the seats at each celebrity table were for the honourary hosts? Explain.

   b. What percent of all the seats were for the honourary hosts? Explain.

9. The banquet and program lasted 4 h. If 25% of this time was for speeches, how much time was spent for speeches?

10. Explain your strategy for finding the percent

a. represented by the common fraction $\frac{3}{4}$

b. represented by the decimal 0.34

Check your answers on pages 116 to 119 in the Appendix.

Challenge Activity

Kids Active In Town (KAIT) is a volunteer youth group that works on various community projects. When 5 new girls joined the group, the percent of girls increased from 40% to 50%. How many boys were members of KAIT?

Check your answer on pages 119 to 121 in the Appendix.

Conclusion

In this lesson you were introduced to percent as a ratio that compares a number to 100. You saw how percent is used in everyday life and used it to solve problems.

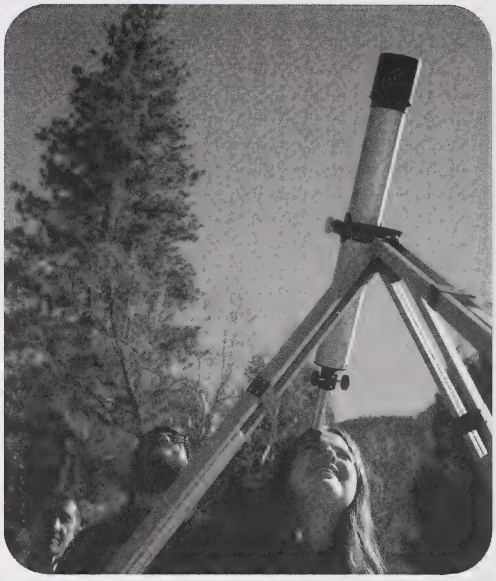
Percents are part of everyday experience and conversation. If you watch weather forecasts on television, you likely have noticed that the probability of precipitation is expressed as a percent. If the likelihood of rain tomorrow is 80%, for example, you should dress accordingly or bring an umbrella. What do you think the probability is for a sunny day in your area tomorrow?

Turn to Assignment Booklet 4B and complete the Lesson 3 Assignment.

Keep Assignment Booklet 4B until you have completed the entire booklet.

Module Summary

In Module 4 you extended your understanding of fractions to include improper fractions and mixed numbers. You learned how to express improper fractions as mixed numbers and to express mixed numbers as improper fractions. You were introduced to ratios and saw how they are used in daily life. You modelled ratios with objects and connected the models to pictures and symbols. You learned that percent is a ratio that compares a number to 100. You applied these ideas to solve problems.



The use of fractions, ratio, and percent are a necessity when astronomers compare Earth and other planets, such as Mars. Astronomers believe that even though Mars is one-and-a-half times farther from the sun than Earth, Mars, like Earth, lies within the habitable zone of the solar system, where liquid water can occur and life can arise. Earth and Mars were even more similar over 3.5 billion years ago. Both had liquid water and Mars was warmer, cloaked in a heavier atomosphere. Do you think astronauts will find evidence of life on Mars?

Turn to Assignment Booklet 4B and complete the Numbers in the News project.

When you are done, submit Assignment Booklet 4B to your teacher to be marked.

Keystrokes

Take out your calculator and complete the following exercises. They will help you review some of the ideas you have learned in Module 4.

Funky Feature: Between the Points

The activities in this feature focus on the relationship between common fractions and decimals. For the first activity, guess a common fraction between two decimals but that does **not** have a denominator equal to 10, 100, 1000, and so on.

Example

Guess a common fraction between 0.25 and 0.32. Begin by identifying a benchmark fraction that has a denominator that is equal to 10, 100, 1000, ... Use this fraction as a starting point or benchmark for a guess-and-test strategy.

You know that you are looking for a fraction close to $\frac{3}{10}$, so try $\frac{4}{11}$.

To test your guess, divide 4 by 11.

Keystrokes	ON/C	4	÷	11	=
Display	0	4	4	11	0.3636363

That's too large. $0.363\,636\,3 > 0.32$, so $\frac{4}{11} > 0.32$. To form a smaller fraction, either make the denominator larger or make the numerator smaller. Try $\frac{4}{17}$.

To test your guess, divide 4 by 17.

Keystrokes	ON/C	4	÷	17	=
Display	0	4	4	17	0.2352941

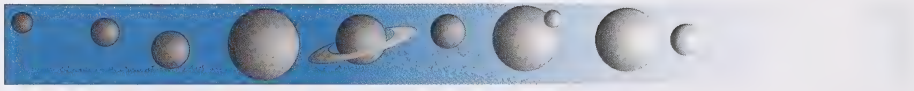
That's too small. $0.235\,294\,1 < 0.25$, so $\frac{4}{17} < 0.25$. Form a larger fraction by lowering the denominator. Try $\frac{4}{15}$.

To test your guess, divide 4 by 15.

Keystrokes	ON/C	4	÷	15	=
Display	0	4	4	15	0.2666666

That's correct! $0.25 < 0.266\,666\,6 < 0.32$, so $0.25 < \frac{4}{15} < 0.32$.

Note: There are an infinite number of fractions that are correct, including $\frac{3}{11}$, $\frac{4}{15}$, and $\frac{4}{13}$.



For questions 1 to 5, identify a benchmark fraction and then find a common fraction between the decimals given.

1. 0.42 and 0.49 **2.** 0.67 and 0.75 **3.** 0.85 and 0.94

4. 0.11 and 0.16 **5.** 0.33 and 0.35

Check your answers on pages 121 and 122 in the Appendix.

Now you have to guess a decimal between two fractions. This requires sharper estimation skills because you only get one try. There are, however, an infinite number of correct answers!

Example 1

Guess a decimal between $\frac{4}{11}$ and $\frac{5}{11}$. Begin by identifying a benchmark fraction that has a denominator equal to 10, 100, 1000, and so on. You know that you are looking for a decimal close to $\frac{5}{10}$, so guess 0.5.

To test your guess, divide 4 by 11 and divide 5 by 11.

Keystrokes	ON/C	4	÷	11	=
Display	0	4	4	11	0.3636363

Keystrokes	ON/C	5	÷	11	=
Display	0	5	5	11	0.4545454

That's too big. 0.5 > 0.454 545 4 (It looks like you should have guessed 0.4.)

Example 2

Guess a decimal between $\frac{3}{5}$ and $\frac{5}{6}$. Think of a decimal a bit bigger than a benchmark fraction of $\frac{6}{10}$. Try 0.7.

To test your guess, divide 3 by 5 and divide 5 by 6.

Keystrokes	ON/C	3	÷	5	=
Display	0	3	3	5	0.6

Keystrokes	ON/C	5	÷	6	=
Display	0	5	5	6	0.8333333

That's correct because 0.6 < 0.7 < 0.833 333 3.

For questions 6 to 10, find a decimal between the fractions given.

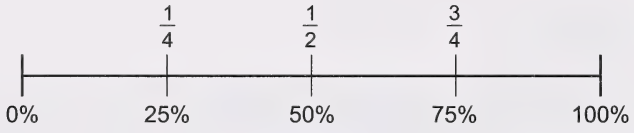
6. $\frac{1}{5}$ and $\frac{1}{4}$ **7.** $\frac{3}{8}$ and $\frac{3}{7}$ **8.** $\frac{1}{3}$ and $\frac{1}{2}$

9. $\frac{2}{3}$ and $\frac{4}{5}$ **10.** $\frac{3}{7}$ and $\frac{5}{8}$

Check your answers on pages 122 and 123 in the Appendix.

Funky Feature: Percent Target

For this activity you are to make an estimate and then use the [%] key on your calculator to find the answer. After doing each question, check to see if your estimate falls within the target range given in the Appendix and if your calculator answer is correct. To help estimate percents, you may find it useful to visualize a number line with the following benchmarks.



Example

What is 35% of 248?

Round to benchmarks and compatible numbers and find $\frac{1}{3}$ of 240.

- $240 \div 3 = 80$, so an estimate for 35% of 248 is 80.
- Use your calculator.

Keystrokes	ON/C	248	×	35	%
Display	0	248	248	35	74.4

So, 35% of 248 is 74.4.

Now, check to see if the estimate is in the target range and if the calculated answer is correct. The target range for this question is 63 to 86. The estimate of 80 is within this range and the answer is indeed 74.4, so great job!

For each of questions 11 to 15, show an estimate and use your calculator to get the answer. Then check to see if your estimate is in the target range shown in the Appendix and if your calculation is correct.

11. 42% of 305

12. 65% of 95

13. 22% of 179

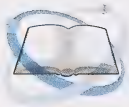
14. 25% of 215

15. 35% of 148

Check your answers on pages 123 and 124 in the Appendix.

Review

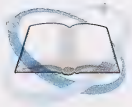
This Review will help you apply what you learned in Module 4 and prepare for the final test. Discuss with your home instructor when you should begin the Review and how much of the Review you should complete.



1. Turn to pages 196 and 197 of your textbook to Pioneer Picnic. Use the recipe for Eve's Bread Pudding on page 197.

   a. Use centicubes to model the number of $\frac{1}{4}$ cups of sugar you would need to double the recipe. Use one centicube for each $\frac{1}{4}$ cup. Draw a picture that shows your work and write the improper fraction that your picture shows.

   b. Combine the centicubes you used in question 1.a. so they represent a mixed number. Draw a picture to show your work and write the mixed number your picture shows.



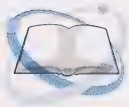
Turn to page 186 of your textbook to Using Fractions and Decimals.

2. **a.** For question 1.b., copy the diagram and label it to show the area as a whole or mixed number.

   b. Copy the diagram again. Draw dotted lines and label the pieces to show the area as an improper fraction.

3. **a.** For question 1.c., copy the diagram and write the length of the rectangle as a mixed number with a proper fraction. Label the diagram to show the area as a whole or mixed number.

   b. Copy the diagram again. Draw dotted lines and label the pieces to show the area as an improper fraction.



4. Turn to Starting Out on page 181 of your textbook. The information given says that most families produce between 20 kg and 45 kg of garbage each week. For each of these weekly amounts, represent the amount of garbage produced in one day as an improper fraction and as a mixed number.

5. Pattern blocks can be used to model fractions.

   a. If the value of the yellow hexagon is one whole, tell what value each other different colour of block represents.

   b. Explain different ways to model 1 whole instead of using a single yellow hexagon.

   c. Explain different ways to model $\frac{1}{2}$ instead of using a single red trapezoid.

   d. Using your previous answers, draw pictures to show different ways to model $2\frac{1}{2}$.

If you need help with questions 1 to 5, look back at Lesson 1, where you learned about improper fractions and mixed numbers. If you feel you need more practice, do questions 6 and 7.

6. Turn to page 197 of your textbook to Pioneer Picnic. Use the recipe for Apple Betty. Find the amount of butter, brown sugar, and flour needed to double the recipe. Draw and label diagrams to show the amount of each ingredient as an improper fraction and as a mixed number.

7. Use a set of pattern blocks. If the value of the blue rhombus is 1 whole, make a pattern with a value of $3\frac{1}{2}$.

Check your answers on pages 125 to 128 in the Appendix.

8. Turn to pages 102 and 103 of your textbook. Do questions 1 and 2 of On Your Own.

9. Turn to page 103 of your textbook. Do questions 1 to 3 of Practise Your Skills.

If you need help with questions 8 and 9, look back at Lesson 2, where you learned about ratios. If you feel you need more practice, do questions 10 and 11.

10. Turn to page 145 of your textbook. Do question 6 of Skill Bank Looking Back.

11. Turn to page 175 of your textbook. Do question 1 of Skill Bank Looking Back.

Check your answers on pages 128 to 130 in the Appendix.

12. Turn to page 105 of your textbook. Do questions 1 to 4 of On Your Own.

13. Turn to page 107 of your textbook. Do questions 1 to 4 of Practise Your Skills.

14. Turn to page 115 of your textbook. Do questions 1 and 2 of On Your Own.

15. Turn to page 122 of your textbook. Do question 4 of Skill Bank.

16. Turn to page 132 and 133 of your textbook. Do questions 1 to 6 of On Your Own.

17. Turn to page 144 of your textbook. Do questions 2 and 3 of Skill Bank.

If you need help with questions 12 to 17, look back at Lesson 3, where you learned about percent. If you feel you need more practice, do questions 18, 19, and 20.

18. Turn to page 145 of your textbook. Do questions 7 and 8 of Skill Bank Looking Back.

19. Turn to page 122 of your textbook. Do question 2 of Skill Bank.

20. Turn to page 175 of your textbook. Do questions 3, 4, 6, and 7 of Skill Bank Looking Back.

Check your answers on pages 130 to 135 in the Appendix.

21. Turn to pages 118 to 121 of your textbook to Problem Bank.

- **a.** Do question 1 or 2.
- **b.** Do question 4.
- **c.** Do question 7.
- **d.** Do question 9 or 10.

22. Turn to pages 142 and 143 of your textbook to Problem Bank.

- **a.** Do question 1 or 2.
- **b.** Do question 4.
- **c.** Do question 5 or 6.
- **d.** Do question 7.

23. Turn to pages 198 to 201 of your textbook to Problem Bank.

Do question 1 or 2. Model and solve the problem with centicubes. Draw pictures to show your work. (For question 1, use one centicube for each $\frac{1}{4}$ ball of yarn. For question 2, use one centicube for each $\frac{1}{4}$ tub of apples.)

Check your answers on pages 135 to 139 in the Appendix.

If you need additional practice to master the material in this module, work through the following lessons on the Mathematics 6 Companion CD:

- Lesson 2: Improper Fractions and Mixed Numbers
- Lesson 3: Ratio
- Lesson 4: Percent

After each lesson, you can print an assignment by clicking on the Activity button at the bottom of the screen.

Ask your home instructor to print out the solutions to the questions in the activity by clicking on the Parent Notes button. Discuss your answers with your home instructor.

Just the Facts

Ask your home instructor to time you as you complete the following timed drill. Your goal is to complete all 25 questions in two minutes. At the end of two minutes, count how many questions you were able to complete. Then use the Answer Key in the Appendix to mark the drill, and record your score in the space provided. Before you move on, go back and complete any questions you did not finish.

Multiplication and Division Facts

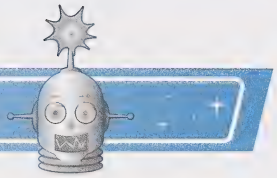
$0 \times 3 =$	$18 \div 9 =$	$\begin{array}{r} 2 \\ \times\ 5 \\ \hline \end{array}$	$4\overline{)36}$	$7 \times 4 =$
$40 \div 8 =$	$\begin{array}{r} 1 \\ \times\ 3 \\ \hline \end{array}$	$3\overline{)3}$	$4 \times 8 =$	$42 \div 6 =$
$\begin{array}{r} 2 \\ \times\ 1 \\ \hline \end{array}$	$5\overline{)15}$	$9 \times 6 =$	$3 \div 1 =$	$\begin{array}{r} 0 \\ \times\ 2 \\ \hline \end{array}$
$6\overline{)48}$	$1 \times 7 =$	$10 \div 2 =$	$\begin{array}{r} 9 \\ \times\ 3 \\ \hline \end{array}$	$2\overline{)8}$
$6 \times 6 =$	$0 \div 4 =$	$\begin{array}{r} 4 \\ \times\ 8 \\ \hline \end{array}$	$4\overline{)24}$	$3 \times 5 =$

Multiplication and Division Facts

Number completed in 2 minutes: _____
Number correct in 2 minutes: _____

Record your score on the Just the Facts Progress Chart.

Mental Math



In Module 3 you saw how the **associative property** helps you add numbers mentally by changing the order in which you add them. Happily, the associative property works for multiplication, too! This tip will show you how to **factor** numbers and then rearrange them so you can multiply **compatible** numbers. To **factor** a number, you write it as a product of its factors.

Compatible numbers are numbers that are easy to multiply mentally. They may be

- basic facts
- factors that have products of 10, 100, 1000, . . .
- familiar numbers that you often multiply

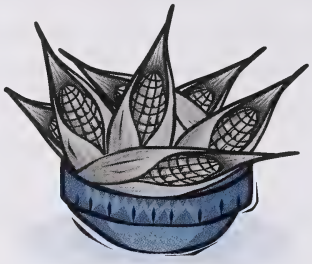
Example 1

Suppose you want to buy 6 pairs of socks for \$2.50 a pair. The cost (before GST) will be $6 \times \$2.50$, which equals $3 \times \$5 = \$15$.

- **Factor** 6 as 3×2.
- The cost will be $(3 \times 2) \times \$2.50$.
- $2 \times \$2.50$ are **compatible** because they are familiar numbers you often multiply.
- $$\begin{aligned}(3 \times 2) \times \$2.50 &= 3 \times (2 \times \$2.50) \\ &= 3 \times (\$5.00) \\ &= \$15.00\end{aligned}$$

Example 2

Fran planted 35 rows of corn with 40 plants in each row. The total number of corn plants is 35×40, which equals $7 \times 100 \times 2 = 1400$.



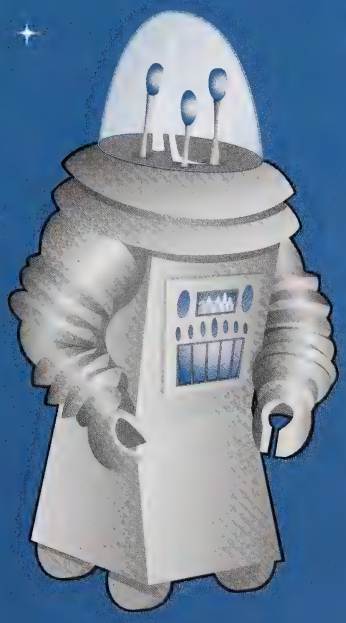
- **Factor** 35 as 7×5 and **factor** 40 as 20×2.
- The total number of corn plants is $(7 \times 5) \times (20 \times 2)$.
- 5×20 are **compatible** because they have a product of 100.
- $$\begin{aligned}(7 \times 5) \times (20 \times 2) &= 7 \times (5 \times 20) \times 2 \\ &= 7 \times 100 \times 2 \\ &= 700 \times 2 \\ &= 1400 \text{ corn plants}\end{aligned}$$

Try to practise these strategies whenever it is appropriate to use them.

Mathematics 6

Appendix

Glossary
Answer Key
Image Credits
Learning Aids



Glossary

denominator: in a fraction, the number below the bar

equivalent fractions: fractions that represent the same amount

improper fraction: a fraction with a numerator that is larger than its denominator

lowest terms: the simplified form of a fraction

mixed number: a whole number plus a proper fraction

numerator: in a fraction, the number above the bar

percent: out of a hundred

ratio: a comparison of quantities

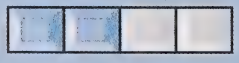
simplifying a fraction: expressing a fraction as an equivalent fraction with the least possible denominator

Answer Key

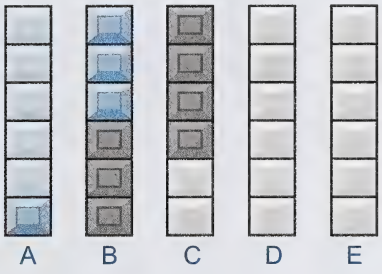
Lesson 1: Improper Fractions and Mixed Numbers

Activity 1

1.

Nutrient Bar	Fraction of Bar Used	Fraction of Bar Left Over
	$\frac{2}{6}=\frac{1}{3}$	$\frac{4}{6}=\frac{2}{3}$
	$\frac{6}{8}=\frac{3}{4}$	$\frac{2}{8}=\frac{1}{4}$
	$\frac{3}{5}$	$\frac{2}{5}$
	$\frac{2}{4}=\frac{1}{2}$	$\frac{2}{4}=\frac{1}{2}$
	$\frac{5}{6}$	$\frac{1}{6}$

2. a. Each of the seven pieces she used with the third soil sample are shown as .



b. $\frac{16}{6} = 16 \div 6$

$= 2 \text{ R}4$

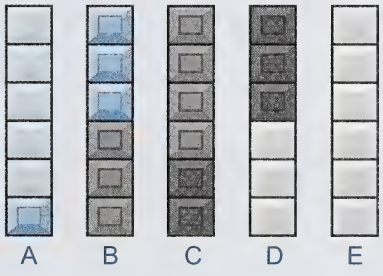
$\frac{16}{6} = 2\frac{4}{6}$

$= 2\frac{4 \div 2}{6 \div 2}$

$= 2\frac{2}{3}$

The first three soil samples used $2\frac{2}{3}$ nutrient bars.

3. a. Each of the five pieces she used with the fourth soil sample are shown as .



b. $\frac{21}{6} = 21 \div 6$

$= 3 \text{ R}3$

$\frac{21}{6} = 3\frac{3}{6}$

$= 3\frac{3 \div 3}{6 \div 3}$

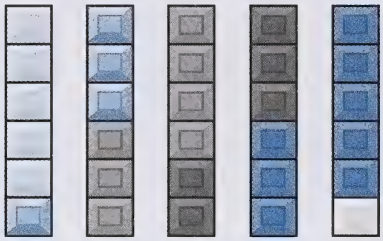
$= 3\frac{1}{2}$

The first four soil samples used $3\frac{1}{2}$ nutrient bars.

4. a. $\frac{4}{3} = \frac{4 \times 2}{3 \times 2}$

$= \frac{8}{6}$

b. Each of the eight pieces she used with the fifth soil sample are shown as .



c. $\frac{29}{6} = 29 \div 6$

$= 4 \quad R5$

$\frac{29}{6} = 4\frac{5}{6}$

The complete project used $4\frac{5}{6}$ nutrient bars.

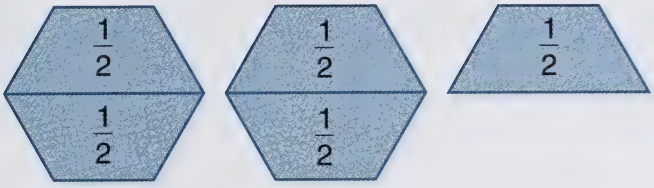
d. When the project was completed, $\frac{1}{6}$ of a bar was left over.

5.

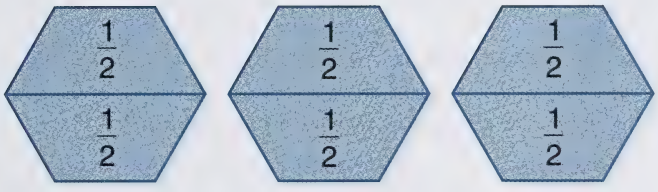
Soil Sample	**1**	**2**	**3**	**4**	**5**
Number of Pieces Used for That Soil Sample	3	5	6	5	3
Total Number of Pieces Used So Far	3	8	14	19	22
Total Number of Bars Used So Far	$\frac{3}{4}$	$\frac{8}{4} = 2$	$\frac{14}{4} = 3\frac{2}{4}$ $= 3\frac{1}{2}$	$\frac{19}{4} = 4\frac{3}{4}$	$\frac{22}{4} = 5\frac{2}{4}$ $= 5\frac{1}{2}$

Activity 2

1.



2. a. You can make three hexagonal tables with six trapezoidal tables.



b. You can make $\frac{6}{2} = 3$ hexagonal tables.

3.

Number of Trapezoidal Tables Used	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Number of Hexagonal Tables Made (fraction)	$\frac{2}{2}$	$\frac{3}{2}$	$\frac{4}{2}$	$\frac{5}{2}$	$\frac{6}{2}$	$\frac{7}{2}$	$\frac{8}{2}$
Number of Hexagonal Tables Made (whole/ mixed number)	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4

4. The only number of trapezoidal tables you could have left over is one. If you have an even number of tables, they all form pairs and you will have no tables left over. If you have an odd number of tables, you will have one table left over.

5.

Number of Rhombus-Shaped Tables Used	3	4	5	6	7	8	9	10
Number of Hexagonal Tables Made (fraction)	$\frac{3}{3}$	$\frac{4}{3}$	$\frac{5}{3}$	$\frac{6}{3}$	$\frac{7}{3}$	$\frac{8}{3}$	$\frac{9}{3}$	$\frac{10}{3}$
Number of Hexagonal Tables Formed (whole/ mixed number)	1	$1\frac{1}{3}$	$1\frac{2}{3}$	2	$2\frac{1}{3}$	$2\frac{2}{3}$	3	$3\frac{1}{3}$

6. You can have only one or two rhombus-shaped tables left over if you used as many of them as possible to make hexagonal tables. Every three rhombus-shaped tables form one hexagonal table, so if the number of tables you have is a multiple of 3, you will have exactly enough to form hexagonal tables with no tables left over.

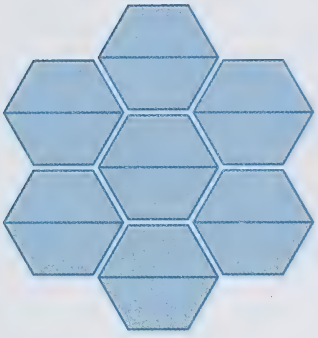
7.

Number of Triangular Tables Used	6	7	8	9	10	11	12	13
Number of Hexagonal Tables Made (fraction)	$\frac{6}{6}$	$\frac{7}{6}$	$\frac{8}{6}$	$\frac{9}{6}$	$\frac{10}{6}$	$\frac{11}{6}$	$\frac{12}{6}$	$\frac{13}{6}$
Number of Hexagonal Tables Made (whole/ mixed number)	1	$1\frac{1}{6}$	$1\frac{2}{6}$ $=1\frac{1}{3}$	$1\frac{3}{6}$ $=1\frac{1}{2}$	$1\frac{4}{6}$ $=1\frac{2}{3}$	$1\frac{5}{6}$	2	$2\frac{1}{6}$

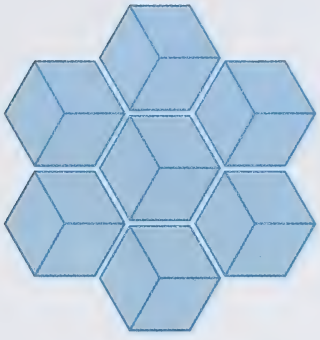
8. You can have one, two, three, four, or five triangular tables left over if you used as many of them as possible to make hexagonal tables. Every six triangular tables form one hexagonal table, so if the number of tables you have is a multiple of 6, you will have exactly enough to form hexagonal tables with no tables left over.

a You can make 7 hexagonal-shaped tables by using

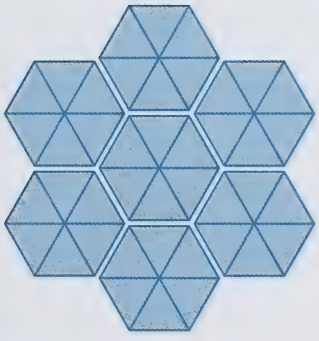
- 14 trapezoidal tables



- 21 rhombus-shaped tables

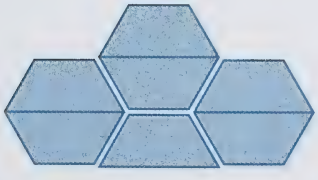


- 42 triangular tables

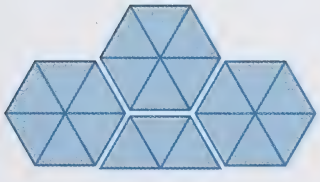


You can make $3\frac{1}{2}$ hexagonal-shaped tables by using

- 7 trapezoidal tables

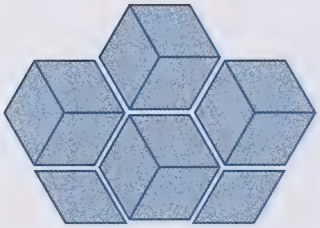


- 21 triangular tables

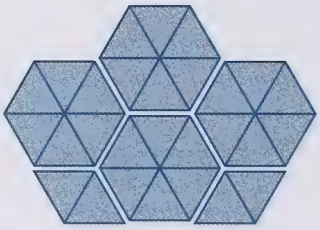


c. You can make $4\frac{2}{3}$ hexagonal-shaped tables by using

- 14 rhombus-shaped tables



- 28 triangular tables



10. The fractions $\frac{14}{2}$, $\frac{21}{3}$, and $\frac{42}{6}$ are equivalent to 7.

The fractions $\frac{7}{2}$ and $\frac{21}{6}$ are equivalent to $3\frac{1}{2}$.

The fractions $\frac{14}{3}$ and $\frac{28}{6}$ are equivalent to $4\frac{2}{3}$.

11. To change a mixed number into its equivalent improper fraction keep the denominator the same. To get the numerator of the improper fraction, multiply the whole number and the denominator of the mixed number and then add the numerator.

12. a. $1\frac{3}{4} = \frac{(4\times1)+3}{4} = \frac{4+3}{4} = \frac{7}{4}$

b. $2\frac{5}{8} = \frac{(8\times2)+5}{8} = \frac{16+5}{8} = \frac{21}{8}$

c. $6\frac{3}{4} = \frac{(4\times6)+3}{4} = \frac{24+3}{4} = \frac{27}{4}$

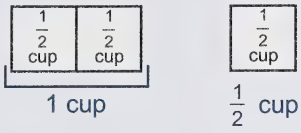
d. $9\frac{2}{3} = \frac{(3\times9)+2}{3} = \frac{27+2}{3} = \frac{29}{3}$

e. $5\frac{1}{2} = \frac{(2\times5)+1}{2} = \frac{10+1}{2} = \frac{11}{2}$

f. $11\frac{2}{3} = \frac{(3\times11)+2}{3} = \frac{33+2}{3} = \frac{35}{3}$

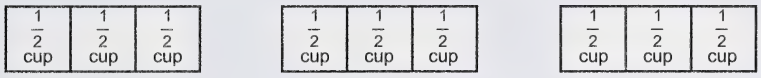
Activity 3

1. a. Three centicubes represent $1\frac{1}{2}$ cups of flour.



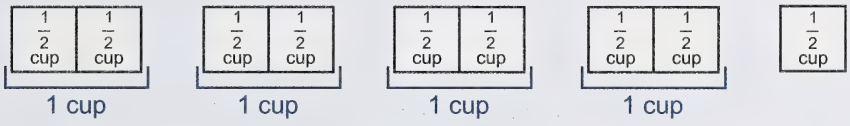
b. She needs $\frac{3}{2}$ cups of flour.

c.



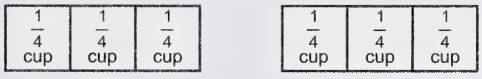
Ms. Moore needs $\frac{9}{2}$ cups of flour to triple the recipe.

d. Pair up the nine centicubes as much as possible.



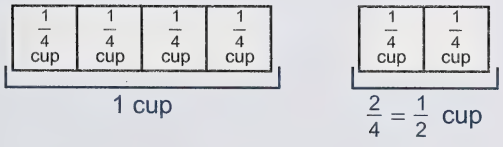
Ms. Moore needs $4\frac{1}{2}$ cups of flour to triple the recipe.

2. a. Two sets of three centicubes is six centicubes.



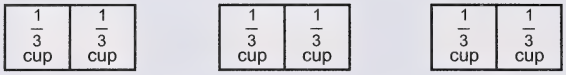
Ms. Moore needs $\frac{6}{4}$ cups of raisins to double the recipe.

b.



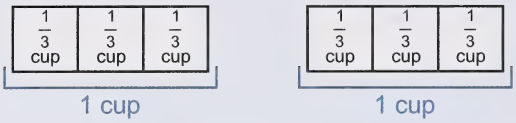
Ms. Moore needs $1\frac{2}{4} = 1\frac{1}{2}$ cups of raisins to double the recipe.

3. a. Three pairs of centicubes is six centicubes.



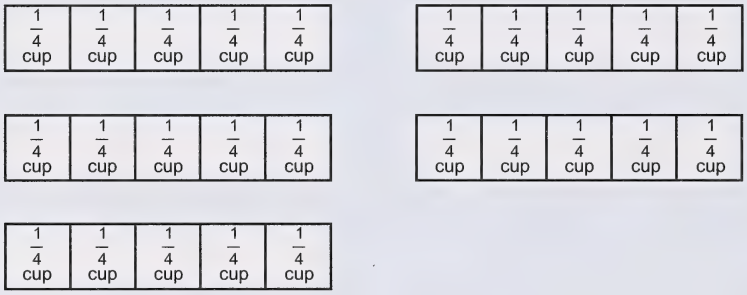
Ms. Moore needs $\frac{6}{3}$ cups of sugar to triple the recipe.

b.



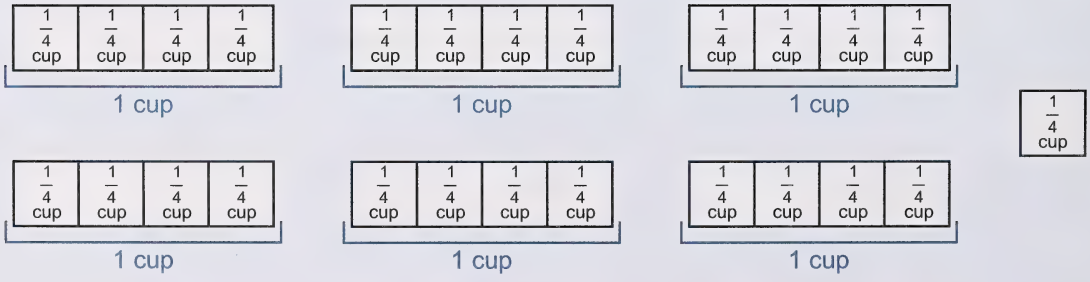
Ms. Moore needs two cups of sugar to triple the recipe.

4. a. Five centicubes represent $1\frac{1}{4}$ cups because $\frac{5}{4} = 1\frac{1}{4}$.



Ms. Moore needs $\frac{25}{4}$ cups of chocolate chips to make 5 times as many cookies as usual.

b. Make as many sets of four centicubes as possible.



Ms. Moore needs $6\frac{1}{4}$ cups of chocolate chips to multiply the recipe 5 times.

5. a. 1 half-dozen + 1 half-dozen + 1 half-dozen = 3 half-dozen

$$= \frac{3}{2} \text{ dozen}$$

1 dozen + 1 half-dozen $= 1\frac{1}{2}$ dozen

b. The cost to buy 18 cookies is \$6. Different solutions are possible. Sample solutions are given.

- \$4 per dozen means \$2 for a half-dozen.

$$18 \text{ cookies} = \frac{3}{2} \text{ dozen}$$
$$= 3 \text{ half-dozen}$$

Therefore, the total cost is $3 \times \$2 = \$6$.

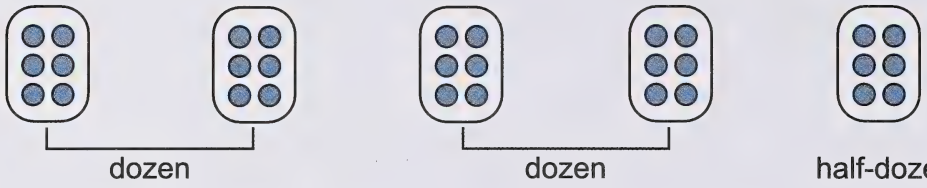
- \$4 per dozen means \$2 for a half-dozen. Therefore, the cost of $1\frac{1}{2}$ dozen cookies equals the cost of 1 dozen and a half-dozen.

$$\$4 + \$2 = \$6$$

c. The raisin cookies will cost Mr. Burns $1\frac{1}{2}$ dollars $= \$1.50$. This is because, at \$1 per dozen, $1\frac{1}{2}$ dozen cookies will cost $1\frac{1}{2}$ dollars $= \$1.50$. Both ways use 1 to represent a whole dollar. Half a dollar is 50 cents and the half-dollar is written as \$0.50.

6. a. Three cookies each for ten children is 30 cookies.

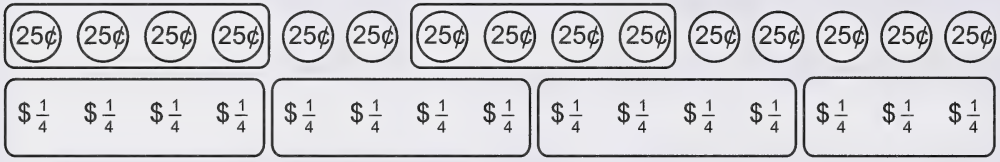
$$\underbrace{\frac{1}{2}}_{\text{half-dozen}} + \underbrace{\frac{1}{2}}_{\text{half-dozen}} + \underbrace{\frac{1}{2}}_{\text{half-dozen}} + \underbrace{\frac{1}{2}}_{\text{half-dozen}} + \underbrace{\frac{1}{2}}_{\text{half-dozen}} = \frac{5}{2} \text{ dozen}$$



$$1 + 1 + \frac{1}{2} = 2\frac{1}{2} \text{ dozen}$$

b. 1 dozen costs \$1.50 = 6 quarters, 1 half-dozen costs 3 quarters = 75¢.

\$1 + 50¢ + \$1 + 50¢ + 75¢ = \$3.75



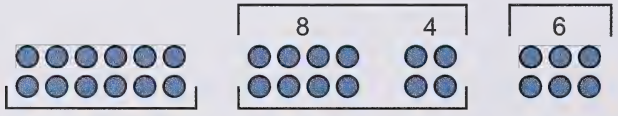
$$\$1 + \$1 + \$1 + = \$\frac{3}{4} = \$3\frac{3}{4}$$

c. The total cost of the oatmeal cookies is \$3.75. This is like the mixed number $3\frac{3}{4}$ dollars because they both use 3 to represent the whole dollars, and $\frac{3}{4}$ of a dollar is 75¢, which is written as \$0.75.

7. Chloe bought $2\frac{1}{2}$ dozen cookies $= \frac{5}{2}$ dozen

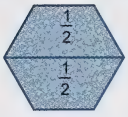
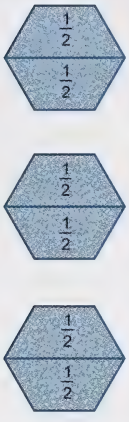
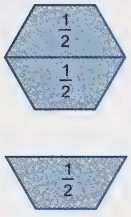
$= 5$ half-dozen boxes

Chocolate Chip 1 dozen + Raisin Coconut 1 dozen + Oatmeal $\frac{1}{2}$ dozen $= 2\frac{1}{2}$ dozen



$\frac{1}{2}$ dozen + $\frac{1}{2}$ dozen + $\frac{1}{2}$ dozen + $\frac{1}{2}$ dozen + $\frac{1}{2}$ dozen = $\frac{5}{2}$ dozen

8.

Coconut	Raisin	Oatmeal	Chocolate Chip
			

Number of Half-Dozens: $1+2+6+3=12$ half-dozen

Number of Dozens: $\frac{1}{2}+1+3+1\frac{1}{2}=6$ dozen

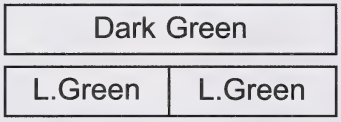
Number of Cookies: $6+12+36+18=72$ cookies

Challenge Activity

1. If you let a dark green rod represent the length of the river-valley trail, then you will use purple rods to represent the length of the route through his neighbourhood because the length of two dark green rods equal the length of three purple rods.

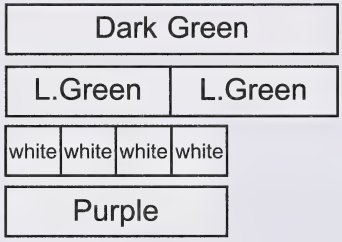
Dark Green	Dark Green	
Purple	Purple	Purple

2. You could use a light green rod to represent the distance Rahim runs in 1 h because the length of two light green rods equals the length of one dark green rod.



3. If it takes Rahim 2 h to complete the river-valley trail, it would take him $1\frac{1}{3}$ h to run his neighbourhood route.

   - Each light green rod is the distance run in 1 h.
   - Compare the length of the light green rod and the length of the purple rod to the length of a white rod. The light green rod is three white rods long, so each white rod is $\frac{1}{3}$ of a light green rod.
   - The purple rod is equal in length to one light green rod plus one white rod $= 1\frac{1}{3}$ light green rods.
   - Similarly, the purple rod is equal in length to four white rods, which are equal to $\frac{4}{3}$ light green rods $= 1\frac{1}{3}$ light green rods.



Lesson 2: Ratios

Activity 1

1. **a.** The number of bags of wet trash accumulated is equal to the number of days.
   b. The number of bags of dry trash accumulated is two times the number of days.

2. a.

Number of Days	1	2	3	4	5	6	7	8	9	10
Number of Bags of Wet Trash Accumulated	1	2	3	4	5	6	7	8	9	10
Number of Bags of Dry Trash Accumulated	2	4	6	8	10	12	14	16	18	20
Total Number of Bags of Trash Accumulated	3	6	9	12	15	18	21	24	27	30

b. The total number of bags of trash accumulated is three times the number of days.

c. The ratio of the number of bags of wet trash accumulated compared to the total number of bags of trash can be written as 1 to 3 or 1:3.

d. The ratio of the number of bags of dry trash accumulated compared to the total number of bags of trash can be written as 2 to 3 or 2:3.

3. a.

Number of Days	1	2	3	4
Number of Bags of Wet Trash Accumulated				
Number of Bags of Dry Trash Accumulated				

b. The number of bags of wet trash accumulated is twice the number of days.

c. The number of bags of dry trash accumulated is three times the number of days.

4. a.

Number of Days	1	2	3	4	5	6	7	8	9	10
Number of Bags of Wet Trash Accumulated	2	4	6	8	10	12	14	16	18	20
Number of Bags of Dry Trash Accumulated	3	6	9	12	15	18	21	24	27	30
Total Number of Bags of Trash Accumulated	5	10	15	20	25	30	35	40	45	50

b. The total number of bags of trash accumulated is five times the number of days.

c. The ratio 2:5 describes the number of bags of wet trash accumulated compared to the total number of bags of trash.

d. The ratio 3:5 describes the number of bags of dry trash accumulated compared to the total number of bags of trash.

5. **a.** The ratio of the number of days Claire was on trash duty compared to the number of days she was on laundry duty can be written as 4 to 3 or 4:3.

b. The ratio of the number of days Chris was on safety check duty compared to the number of days Steve was on safety check duty can be written as 2 to 3 or 2:3.

c. The ratio of the number of days Evan was on supplies check duty compared to the number of days Steve was on supplies check duty can be written as 5 to 1 or 5:1.

d. The ratio of the number of days Julie was on food duty compared to the number of days in the weekly rotation can be written as 5 to 7 or 5:7.

6. The ratio 1 to 3 compares the number of days Chris was on supplies check duty compared to the number of days he was on trash duty.

7. The ratio of 3 to 5 compares the number of days Claire was on laundry duty compared to the number of days Julie was on food duty in the weekly rotation.

8. a. The total number of hours scheduled for sleep is 8 times the total number of days the mission lasts because astronauts are scheduled to sleep 8 hours each day.

b. The total number of hours scheduled for being awake is 16 times the total number of days the mission lasts, because astronauts are scheduled to be awake 16 hours each day.

c. The ratio 1:3 describes the total sleep time compared to total mission time.

9. a. The ratio of the number of hours an astronaut sleeps each day compared to the number of hours the astronaut is awake each day can be written as 8 to 16 or 8:16. You may have simplified this ratio to 1 to 2 or 1:2.

b. The ratio of the number of hours an astronaut sleeps each day compared to the number of hours in a day can be written as 8 to 24 or 8:24. You may have simplified this to 1:3 or 1 to 3.

c. The ratio of the number of hours an astronaut is awake each day compared to the number of hours in a day can be written as 16 to 24 or 16:24. You may have simplified this to 2 to 3 or 2:3.

10. The ratio of the total number of hours that an astronaut is asleep compared to the total of hours the astronaut is awake during one week in space can be written as 56 to 112 or 56:112. This is because

- The total number of hours scheduled for being asleep is 8 times the number of days $(8 \times 7 = 56)$.
- The total number of hours scheduled for being awake is 16 times the number of days $(16 \times 7 = 112)$.

You may have simplified the ratio to 1 to 2 or 1:2.

Activity 2

1. There are more cats than dogs at the shelter. For every 3 cats, there are 2 dogs.

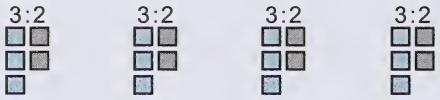
2. a. Cats □□□

Dogs ■■

b. The group of centicubes shows 5 animals in all.

3. a. □ Cats

■ Dogs



Total Animals: 5 + 5 + 5 + 5 = 20

b. There are four separate groups of centicubes in the 3:2 ratio.

c. There are 12 cats and 8 dogs at the shelter.

d.

	Group of Centicubes That Were Added								Total Number
Cats	□□□	+	□□□	+	□□□	+	□□□		12
Dogs	■■	+	■■	+	■■	+	■■		8
Animals	5	+	5	+	5	+	5		20

e. Answers will vary. A sample answer is given.

Each group has 3 cats and 2 dogs and there is a total of 20 animals.

- $3 + 2 = 5$ animals in each group
- $20 \div 5 = 4$ groups needed in all
- $4 \times 3 = 12$ cats at the shelter
- $4 \times 2 = 8$ dogs at the shelter

4. a.

	Groups of Centicubes That Were Added			Total Number
Male Cats	■■■■■	+	■■■■■	10
Female Cats	□	+	□	2
Total Cats	6	+	6	12

b. Answers will vary. A sample answer is given.

Each group has 5 male cats and 1 female cat, and there is a total of 12 cats (from question 3).

- $5+1=6$ cats in each group
- $12\div 6=2$ groups needed in all
- $2\times 5=10$ male cats at the shelter
- $2\times 1=2$ female cats at the shelter

5. Answers will vary. Sample answers are given.

Table Method

	Groups of Centicubes That Were Added			Total Number
Puppies	■	+	■	2
Adult Dogs	■■■	+	■■■	6
Total Dogs	4	+	4	8

Paper-and-Pencil Method

Each set has 1 puppy and 3 adult dogs, and there is a total of 8 dogs (from question 3).

- $3+1=4$ dogs in each group
- $8\div 4=2$ groups needed in all
- $2\times 1=2$ puppies at the shelter
- $2\times 3=6$ adult dogs at the shelter

6. a. The new ratio of cats to dogs can be written as 10 to 9 or 10:9.

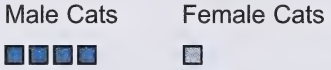
From question 3, there were 12 cats and 8 dogs. Therefore, the new number of animals is $12-2=10$ cats and $8+1=9$ dogs.

b. The new ratio that compares the number of male cats to the number of female cats can be written as 8 to 2 or 8:2.

From question 4, there were 10 male cats and 2 female cats. The new number of male cats is $10-2=8$. There were still 2 female cats.

c. The new ratio of male cats to female cats can be modelled using less blocks and rewritten using smaller numbers.

The model shows that there are now 4 times as many male cats as female cats.



The ratio of male cats to female cats can be written as 4 to 1 or 4:1.

d. The new ratio that compares the total number of puppies to the total number of adult dogs can be written as 3 to 6 or 3:6.

e. The new ratio that compares the number of adult dogs to puppies can be written as 2 to 1 or 2:1. It means there are twice as many adult dogs as puppies.

Activity 3

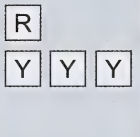
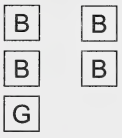
1. a. orange: 1 drop red and 3 drops yellow
The ratio of red drops to yellow drops is 1 to 3 or 1:3.

b. turquoise: 4 drops blue and 1 drop green
The ratio of blue drops to green drops is 4 to 1 or 4:1.

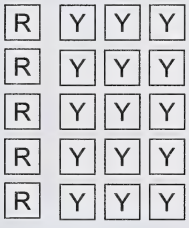
c. mauve: 3 drops red and 1 drop blue
The ratio of red drops to blue drops is 3 to 1 or 3:1.

d. cherry: 2 drops red and 3 drops yellow
The ratio of red drops to yellow drops is 2 to 3 or 2:3.

2.

Blended Colour	Orange	Turquoise	Mauve	Cherry
What to Use to Make One Unit of Blend	1 drop R 3 drops Y	4 drops B 1 drop G	3 drops R 1 drop B	2 drops R 3 drops Y
Total Number of Colour Drops in One Unit of Blend	4	5	4	5
Centicube Model of One Unit of Blend				

3. a.

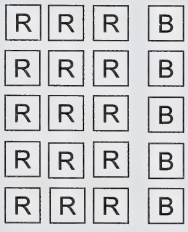


The ratio of red drops to yellow drops is 5 to 15 or 5:15.

b.

The ratio of blue drops to green drops is 16 to 4 or 16:4.

c.



The ratio of red drops to blue drops is 15 to 5 or 15:5.

d.

R	R	Y	Y	Y
R	R	Y	Y	Y
R	R	Y	Y	Y
R	R	Y	Y	Y

The ratio of red drops to yellow drops is 8 to12 or 8:12.

4. a. For 250 mL of boiling water to dye the eggs turquoise, Tiarra needs 32 blue drops and 8 green drops (a ratio of 32:8 or 32 to 8). You need to double the number of drops of each colour that you would need for 125 mL because $250\ \text{mL} = 2 \times 125\ \text{mL}$.

b. For 500 mL of boiling water to dye the eggs mauve, Tiarra needs 60 red drops and 20 blue drops (a ratio of 60:20 or 60 to 20). You need to multiply the number of drops of each colour that you would need for 125 mL by 4 because $500\ \text{mL} = 4 \times 125\ \text{mL}$.

c. For 750 mL of boiling water to dye the eggs cherry, Tiarra needs 48 red drops and 72 yellow drops (a ratio of 48:72 or 48 to 72). You need to multiply the number of drops of each colour that you would need for 125 mL by 6 because $750\ \text{mL} = 6 \times 125\ \text{mL}$.

d. For 1 L of boiling water to dye the eggs orange, Tiarra needs 40 red drops and 120 yellow drops (a ratio of 40:120 or 40 to 120). You need to multiply the number of drops of each colour that you put in 125 mL by 8 because $1\ \text{L} = 8 \times 125\ \text{mL}$.

5. Laurenn's new mauve is created with 3 red drops and 2 blue drops (a ratio of 3 to 2 or 3:2). This unit blend uses 5 drops of colouring. To use 20 drops in total, she must use 4 units (since $20 \div 5 = 4$).

To make 20 drops for 125 mL of boiling water, she needs 4 times the number of drops of each colour.

- Red: 4×3 drops of red $= 12$ drops of red
- Blue: 4×2 drops of blue $= 8$ drops of blue

From question 3.c., she needed 15 drops of red and 5 drops of blue.

$15\ \text{blue} - 12\ \text{blue} = 3\ \text{blue}$, and $5\ \text{red} + 3\ \text{red} = 8\ \text{red}$

6. The ratio in lowest terms that shows the number of drops of blue to yellow colour needed is 3:2. Tiarra's new colour is 3 drops of blue to 2 drops of yellow.

   - She put 24 drops of blue and 16 drops of yellow in 200 mL of boiling water.
   - Half of this is 12 drops of blue and 8 drops of yellow in 100 mL of water.
   - Half of each colour again is 6 drops blue and 4 drops yellow to 50 mL of water.
   - Half of each colour again is 3 drops blue and 2 drops yellow to 25 mL of water.

Challenge Activity

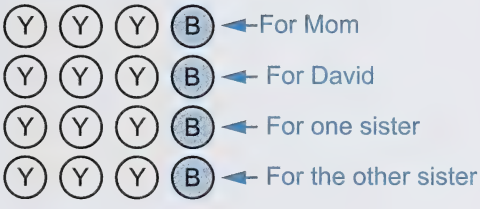
Different solutions are possible. A sample solution is given.

1. David used a total of 12 scoops of yellow paint and 3 scoops of blue paint.

   Continue building an array of coloured counters by using 4 yellow for every 1 blue until a total of 15 counters are used.

2. The ratio of yellow paint to blue paint in each of the four containers was 3 to 1.

   Put in one more blue counter. Rearrange the 16 counters (4 blue and 12 yellow) into an array with four identical rows of counters each.



3. Susan needs to mix in 2 more scoops of blue paint.

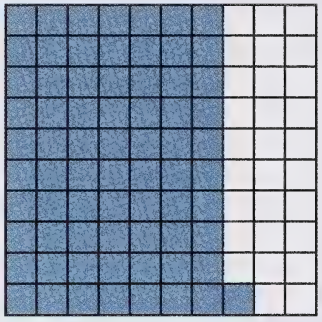
   - Each person was given a container with 3 scoops of yellow paint and 1 scoop of blue paint.

   - Susan wanted the same amount of blue paint as yellow paint in her container. She needed to put in 2 scoops of blue paint because $1+2=3$.

Lesson 3: Percent

Activity 1

1. a. Shade 71 units on the base ten flat to show the area covered by the ocean.

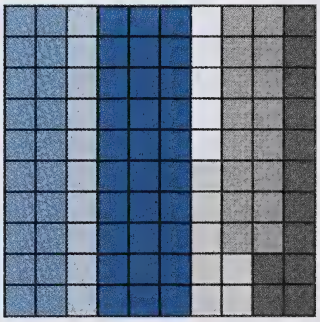


b. The unshaded area represents 29% of the surface area of Earth, the part of Earth that is covered by land. The whole flat represents 100% and $100\% - 71\% = 29\%$.

2. a. The cubes form a 10-by-10 array because there are a total of 100 cubes. Each cube represents 1% and the total amount of land is represented by 100%.

b.

Continent	Colour
Africa	
Antarctica	
Asia	
Australia	
Europe	
North America	
South America	



c. The area of Asia, the largest continent, is 6 times greater than the area of Australia, the smallest continent. Asia covers 30% of Earth's land and Australia covers 5% of Earth's land.

$$6 \times 5\% = 30\%$$

d. The area of North America is about 2 times greater than the area of Europe. North America covers 16% of Earth's land and Europe covers 7% of Earth's land.

$2 \times 7\% = 14\%$, which is just a little less than 16%.

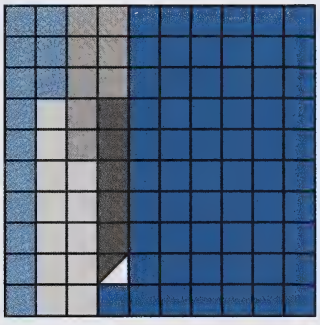
e. Antarctica's area is half of Africa's area. Antarctica covers 10% of Earth's land and Africa covers 20% of Earth's land.

$20\% \div 2 = 10\%$.

3. a. The total of the percents listed for the 7 continents is 100%, that is because the total population is represented by 100%.

b.

Continent	Colour
Africa	
Antarctica	
Asia	
Australia	
Europe	
North America	
South America	



c. Yes, Asia is the continent with the greatest percent of Earth's land (30%), and it also has the greatest percent of the Earth's population (61%).

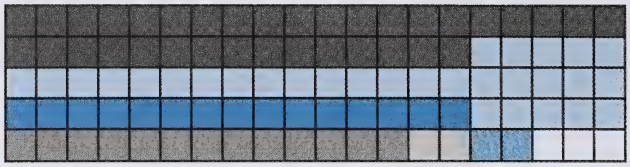
d. Some may say that Australia is the continent with the least percent of Earth's land, and of all the inhabited continents, it has the least percent of Earth's population (0.5%). **Note:** Antarctica has a population of 0. (There are no citizens of Antarctica.)

4. a. Magnesium is 13% of Earth's composition. The sum of all the percents, except for magnesium, is 87%, and $100\% - 87\% = 13\%$.

b. A 20-by-5 grid also is made up of 100 squares.

c.

Element	Colour
Iron	
Oxygen	
Silicon	
Magnesium	
Sulfur	
Nickel	
Other	



d. Iron is the most abundant element in Earth's chemical composition.

e. Together, iron and silicon make up 50% of Earth's composition. Iron is 35% and silicon is 15%.

$$35\% + 15\% = 50\%$$

5. a.

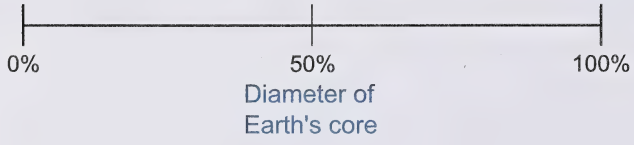
Atmospheric Gas	Percent of Earth's Atmosphere
Nitrogen	78
Oxygen	21
Other	1

Total: 100%

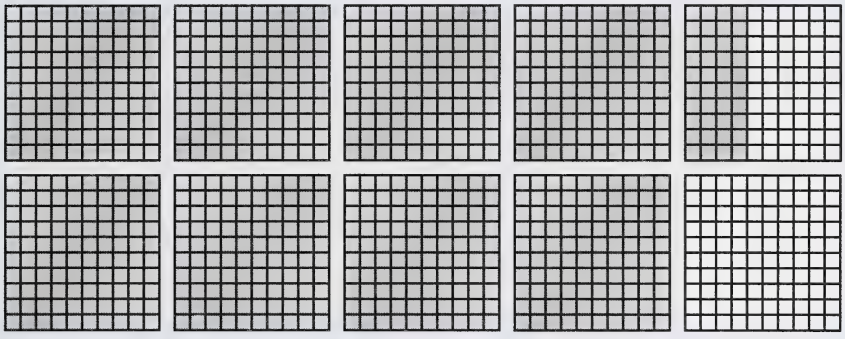
b. The amount of nitrogen in the atmosphere is about 4 times greater than the amount of oxygen. Nitrogen is about 80% and oxygen is about 20%.

$$4 \times 20\% = 80\%$$

6. a.



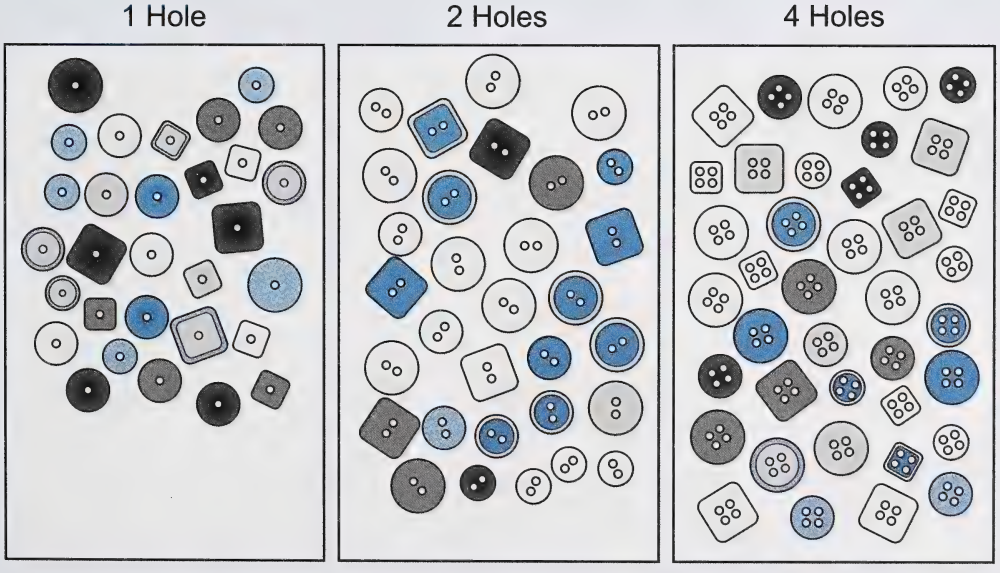
b. Use 8 flats and 4 rods to represent the volume of the mantle. Each flat represents 10%, so 8 flats $= 80\%$. Each rod represents 1%, so 4 rods $= 4\%$. $80\% + 4\% = 84\%$, which is the percent the mantle is of Earth's volume. The following 10 flats represent 100% of Earth's volume. The shaded flats and rods represent the volume of the mantle.



7. If a 1-L container of water represents all the water that covers Earth, 970 mL would represent salt water and 30 mL would represent fresh water. There are 1000 mL in 1 L, so every 10 mL would represent 1%.

Activity 2

1.



2. a. There are 100 buttons in Haley's button box.

b. Each button is $\frac{1}{100} = 0.01$ of the buttons in the box.

c. Each button is 1% of the buttons in the box.

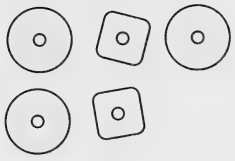
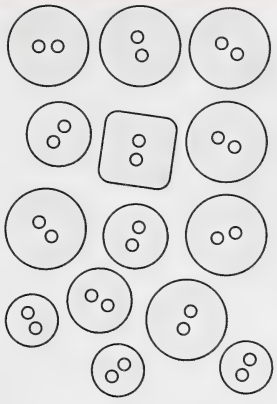
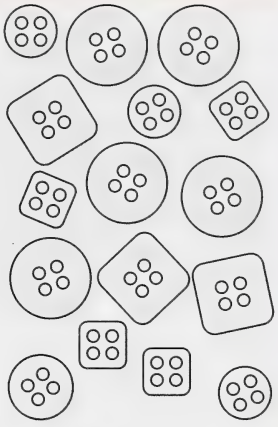
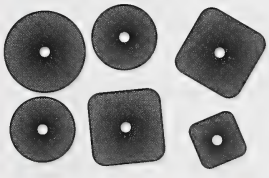
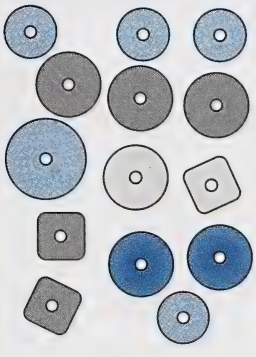
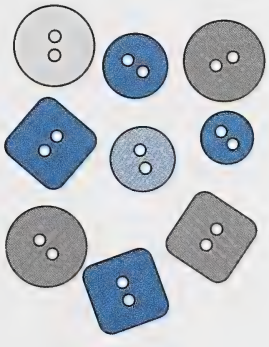
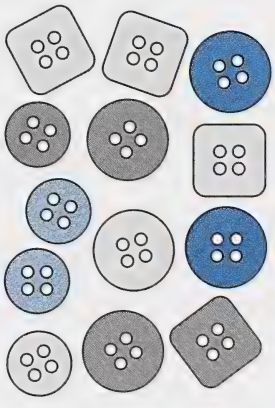
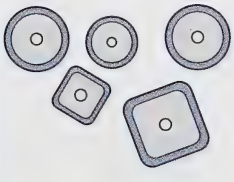
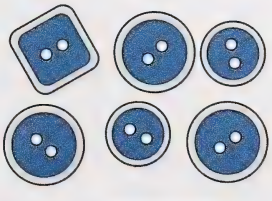
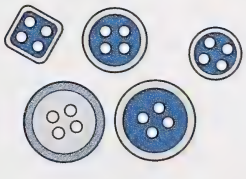
d.

	Number of Buttons	Percent of Buttons
1 Hole	30	30%
2 Holes	31	31%
4 Holes	39	39%
	Total: 100	Total: 100

3. Haley will use 10% of her buttons and 90% of the buttons will be left. She will use 5 one-hole buttons $+ 2$ two-hole buttons $+ 3$ four-hole buttons $= 10$ buttons. She will have $100 - 10 = 90$ buttons left. Each button is 1% of her buttons, so 10 buttons are 10% of her buttons and 90 buttons are 90% of her buttons.

4. After Haley does this, 30% of her buttons will have one hole, 25% will have two holes, and 45% will have four holes. The number of two-hole buttons in her button box will be $31 - 6 = 25$, and the number of four-hole buttons in her button box will be $39 + 6 = 45$. The number of one-hole buttons won't change, so the percent of one-hole buttons won't change.

5. a.

	1 Hole	2 Holes	4 Holes
White			
Black			
Solid Colour			
Multi-Colour			

b.

		Number of Holes			
		1 Hole	2 Holes	4 Holes	Total %
Colour	White	5	14	16	35
	Black	6	2	5	13
	Solid Colour	14	9	13	36
	Multi-Colour	5	6	5	16
	Total %	30	31	39	100

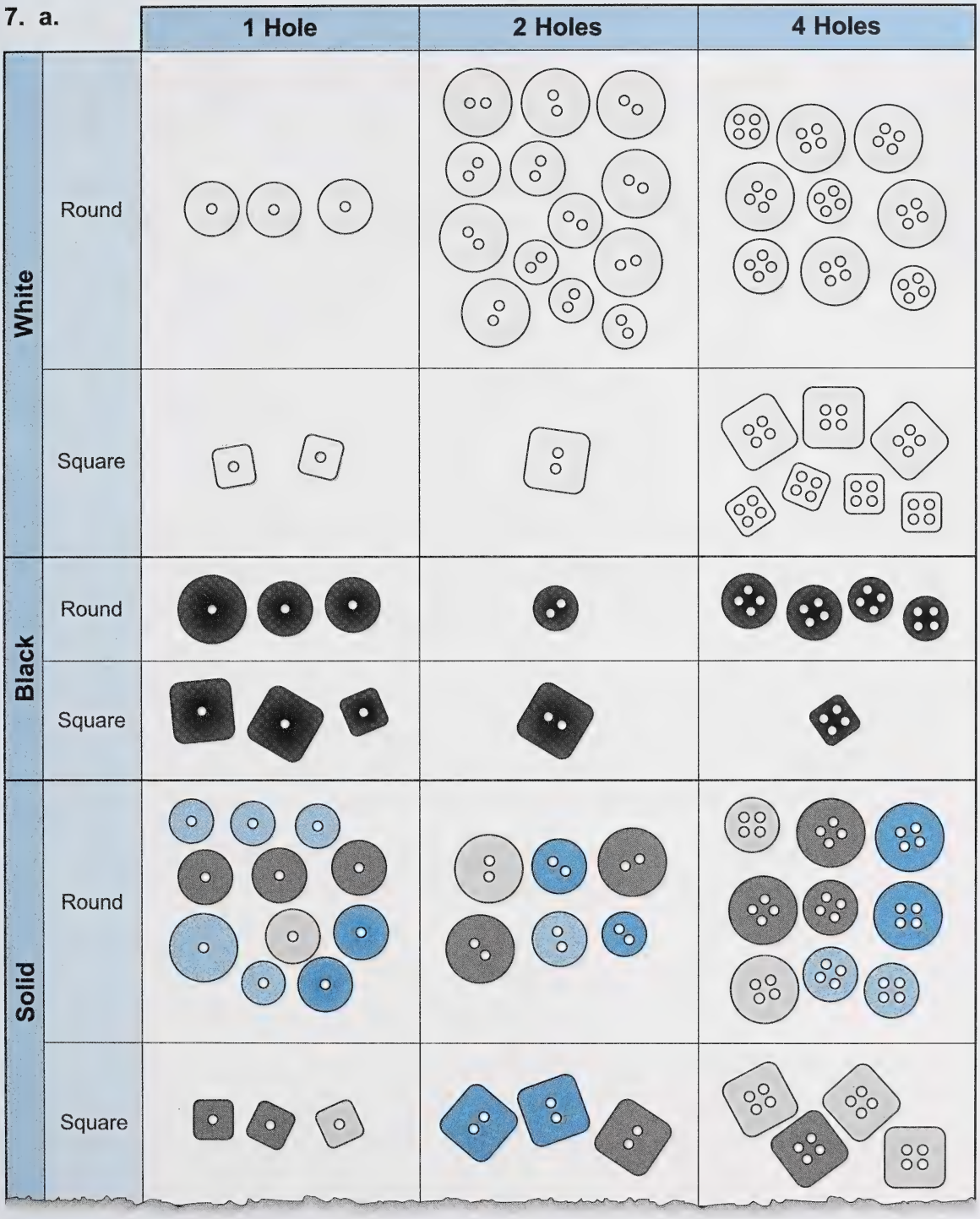
6. Haley will use one solid colour button and add either one black button or one multi-colour button.

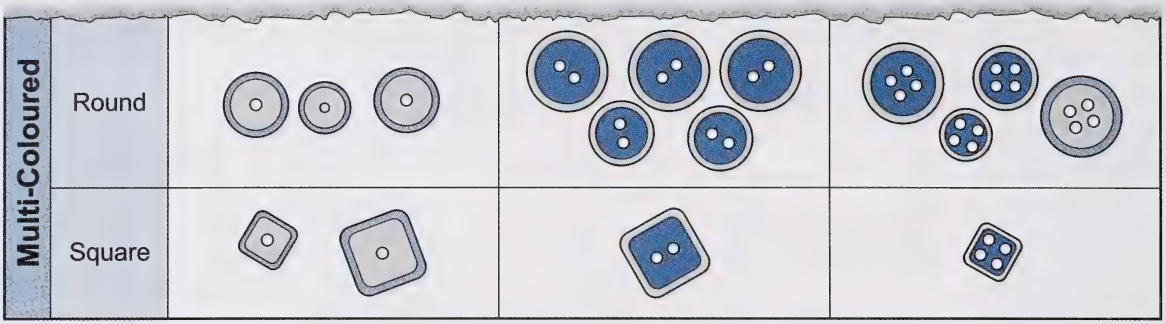
- She will then have $36-1=35$ solid colour buttons $=35\%$ of all the buttons.
- The percent of white buttons is 35% and this doesn't change.
- She will then have either
  - $13+1=14$ black buttons $=14\%$ of all the buttons, and the percent of multi-colour buttons is 16%, so $14\%+16\%=30\%$.

  or

  - $16+1=17$ multi-colour buttons $=17\%$ of all the buttons, and the percent of black buttons is 13% and $17\%+13\%=30\%$.

7. a.


1 Hole
2 Holes
4 Holes
White
Round
Square
Black
Round
Square
Solid
Round
Square



b. $\frac{71}{100} = 0.71 = 71\%$ of all buttons in Haley's button box are round.

$\frac{29}{100} = 0.29 = 29\%$ of all buttons in Haley's button box are square.

Activity 3

1. Three tables is 1% of all the tables. The 300 tables could be put into 100 groups of 3 tables each. Since there are 100 such groups, each group of 3 tables is $\frac{1}{100} = 1\%$ of all the tables.

2. a. $\frac{30}{300}$, $\frac{10}{100}$, and $\frac{1}{10}$

b. 0.1 and 0.10

c. 10%

3. a. tables beside an aisle: $\frac{198}{300} = \frac{66}{100}$, 0.66, 66%

b. tables one table in from an aisle: $\frac{99}{300} = \frac{33}{100}$, 0.33, 33%

c. tables two tables in from an aisle: $\frac{3}{300} = \frac{1}{100}$, 0.01, 1%

4. a. tables with at least one celebrity table right beside them: $\frac{111}{300} = \frac{37}{100}$, 0.37, 37%

b. tables with two celebrity tables right beside them: $\frac{6}{300} = \frac{2}{100}$, 0.02, 2%

5. a. $\frac{51}{198}$ of the aisle tables have a celebrity table immediately beside them.

b. More than one answer is possible. A sample answer is given.

Approximately $\frac{50}{200} = \frac{25}{100} = 0.25 = 25\%$ of the aisle tables have a celebrity table immediately beside them.

6. Three hundred seats were unsold. More than one method is possible. Sample methods are given.

Solution A

- If 90% of the seats were sold, then 10% were unsold.
- Ten percent of the seats at 1 table is 1 seat. Since there are 300 tables, 1 seat at each table is a total of 300 unsold seats.

Solution B

- If 90% of the seats were sold, then 10% were unsold.
- From question 1, 1% of all the tables is 3 tables, so 10% of tables is 30 tables.
- Every table has 10 seats, so there is a total of 300 unsold seats.

7. a. Seven hundred fifty seats were reserved for the organizing committee and volunteers. More than one method is possible. Sample methods are given.

Solution A

- Half of 300 tables is $300 \div 2 = 150$ tables.
- Fifty percent is half, and half of 10 seats is 5 seats, so 5 seats per table $\times$ 150 tables $= 750$ seats.

Solution B

Fifty percent of half of the seats is the same as $\frac{1}{4}$ of the total number of seats, so divide the total number of seats by 4.

$$10 \text{ seats at each of 300 tables} = 10 \times 300$$
$$= 3000 \text{ seats}$$

$$3000 \text{ seats} \div 4 = 750 \text{ seats}$$

b. $\frac{750}{3000} = \frac{25}{100}$ or 0.25 or 25% of all the seats were reserved for the organizing committee and volunteers. (This is $\frac{1}{4}$ of the total number of seats.)

8. a. Twenty percent of the seats at each celebrity table were for the honourary hosts. There are 10 seats at each table and 2 are for the hosts.

$$\frac{2}{10} = \frac{20}{100} \text{ or } 20\%$$

b. Two percent of all the seats were for the honourary hosts.

- There are 30 celebrity tables, and 2 hosts per celebrity table or $2 \times 30 = 60$ hosts.
- 10 seats at each of 300 tables gives 10×300
  $= 3000$ seats
- $\frac{60}{3000} = \frac{2}{100}$ or 2%

9. Speeches lasted 1 h.

- $25\% = \frac{25}{100}$ or $\frac{1}{4}$, and $\frac{1}{4}$ of 4 h means $4 \text{ h} \div 4 = 1 \text{ h}$

10. a. To find the percent represented by the common fraction $\frac{3}{4}$, look for an equivalent fraction whose denominator is 100.

$4 \times 25 = 100$, so $\frac{3}{4} = \frac{75}{100}$ or 75%

b. To find the percent represented by the decimal 0.34, think of it as a fraction whose denominator is 100.

$$0.34 = \frac{34}{100} \text{ or } 34\%$$

Challenge Activity

There were 15 boys in KAIT. (When 5 new girls joined the youth group, the number of girls went up from 10 to 15.) Different solution strategies are possible. Sample solutions are given.

Solution A

Use a table like the one shown below to organize guesses.

- In the beginning, 40% of the group members were girls.

  $40\% = 40{:}100$

  Make guesses using numbers in this ratio. (See the first column of the table.)

- Five new girls join, so add 5 to get the new number of girls (second column) and to get the new total number of youth members (third column). Then find the number of boys (fourth column).

- In the end, $50\% = \frac{1}{2}$ of the youth are girls (and $\frac{1}{2}$ of the youth are boys), so test to see if the new number of girls equals the number of boys (last column).

Numbers in the Starting Ratio of Girls to Total	New Number of Girls (add 5 girls)	Add 5 to the Total Youth in the Group	Number of Boys (the total youth minus the number of girls)	Does the New Number of Girls = Boys
40 girls to 100 youth	$40 + 5 = 45$	$100 + 5 = 105$	$105 - 45 = 60$	No, $45 \neq 60$
20 girls to 50 youth	$20 + 5 = 25$	$50 + 5 = 55$	$55 - 25 = 30$	No, $25 \neq 30$
10 girls to 25 youth	$10 + 5 = 15$	$25 + 5 = 30$	$30 - 15 = 15$	Yes, $15 = 15$

Solution B

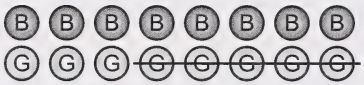
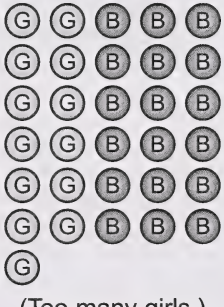
- After 5 girls came, 50% of the members were girls (which means there were the same number of girls as boys). Model this using an equal number of two colours of counters. (See the first column in the following table.)

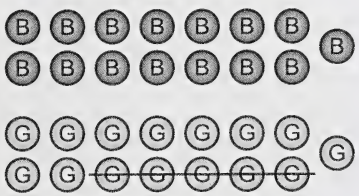
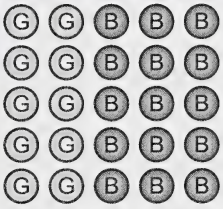
- Work backwards by taking away 5 counters that represent the 5 new girls who joined. The remaining counters can be grouped into sets of 2 girls to 3 boys. This is because before 5 new girls joined, the group was 40% girls, so the ratio of girls to total kids in the group is 40 to 100. Put this in the lowest terms by dividing both terms by the GCF, 20.

  $\frac{40}{100} = \frac{2}{5}$ or 2:5

  This means that there were 2 girls for every 5 youth members, which also means that there were 2 girls for every 3 boys. (See the second column of the following table.)

- Count counters to see how many girls there were.

Use equal numbers of girls and boys (then remove 5 girls).	Try putting the remaining chips into sets of 2 girls to 3 boys.	Conclusion
(Try using 8 of each.)  (Leaves 3G and 8B.)	 (Leaves 3G and 8B.)	Try again using more youth. (The number of boys must be a multiple of 3.)
(Try using 18 of each.) (Leaves 13G and 18B.)	 (Too many girls.)	Try again using less youth. (Keep the number of boys a multiple of 3.)

(Try using 15 of each)  (Leaves 10G and 15B.)	 (It works out perfectly.)	There were 15 boys in KAIT. (There were 10 girls to start with. When 5 new girls joined, there were 15 girls and 15 boys.)

Keystrokes

1. Sample benchmarks: $\frac{4}{10}$, $\frac{5}{10}$, $\frac{47}{100}$

Sample fractions between 0.42 and 0.49: $\frac{4}{9}$, $\frac{5}{11}$, $\frac{47}{99}$

Keystrokes	ON/C	4	÷	9	=	5	÷	11	=	47	÷	99	=
Display	0	4	4	9	0.4444444	5	5	11	0.4545454	47	47	99	0.4747474

2. Sample benchmarks: $\frac{7}{10}$, $\frac{71}{100}$

Sample fractions between 0.67 and 0.75: $\frac{8}{11}$, $\frac{9}{13}$, $\frac{71}{99}$

Keystrokes	ON/C	8	÷	11	=	9	÷	13	=	71	÷	99	=
Display	0	8	8	11	0.7272727	9	9	13	0.6923076	71	71	99	0.7171717

3. Sample benchmarks: $\frac{8}{10}$, $\frac{89}{100}$

Sample fractions between 0.85 and 0.94: $\frac{8}{9}$, $\frac{10}{11}$, $\frac{89}{101}$

Keystrokes	ON/C	8	÷	9	=	10	÷	11	=	89	÷	101	=
Display	0	8	8	9	0.8888888	10	10	11	0.9090909	89	89	101	0.8811881

4. Sample benchmarks: $\frac{1}{10}$, $\frac{11}{100}$

Sample fractions between 0.11 and 0.16: $\frac{1}{9}$, $\frac{2}{13}$, $\frac{11}{98}$

Keystrokes	ON/C	1	÷	9	=	2	÷	13	=	11	÷	98	=
Display	0	1	1	9	0.1111111	2	2	13	0.1538461	11	11	98	0.1122448

5. Sample benchmarks: $\frac{3}{10}$, $\frac{34}{100}$

Sample fractions between 0.33 and 0.35: $\frac{1}{3}$, $\frac{10}{29}$, $\frac{17}{50}$

Keystrokes	ON/C	1	÷	3	=	10	÷	29	=	17	÷	50	=
Display	0	1	3	3	0.3333333	10	10	29	0.3448275	17	17	50	0.34

6. Sample decimals between $\frac{1}{5}$ and $\frac{1}{4}$: 0.21, 0.23, 0.24

Keystrokes	ON/C	1	÷	5	=
Display	0	1	1	5	0.2

Keystrokes	ON/C	1	÷	4	=
Display	0	1	1	4	0.25

7. Sample decimals between $\frac{3}{8}$ and $\frac{3}{7}$: 0.418, 0.42, 0.425

Keystrokes	ON/C	3	÷	8	=
Display	0	3	3	8	0.4175

Keystrokes	ON/C	3	÷	7	=
Display	0	3	3	7	0.4285714

8. Sample decimals between $\frac{1}{3}$ and $\frac{1}{2}$: 0.34, 0.4, 0.49

Keystrokes	ON/C	1	÷	3	=
Display	0	1	1	3	0.3333333

Keystrokes	ON/C	1	÷	2	=
Display	0	1	1	2	0.5

9. Sample decimals between $\frac{2}{3}$ and $\frac{4}{5}$: 0.67, 0.7, 0.75

Keystrokes	ON/C	2	÷	3	=
Display	0	2	2	3	0.6666666

Keystrokes	ON/C	4	÷	5	=
Display	0	4	4	5	0.8

10. Sample decimals between $\frac{3}{7}$ and $\frac{5}{8}$: 0.45, 0.5, 0.6

Keystrokes	ON/C	3	÷	7	=
Display	0	3	3	7	0.4285714

Keystrokes	ON/C	5	÷	8	=
Display	0	5	5	8	0.625

11. 42% of 305 = 128.1

Keystrokes	ON/C	305	×	42	%
Display	0	305	305	42	128.1

Sample estimation strategy using 40% of 300:

40% of 100 is 40, so 40% of 300 = $40 \times 3 = 120$

Target range: 112 to 136

12. 65% of 95 = 61.75

Keystrokes	ON/C	95	×	65	%
Display	0	95	95	65	61.75

Sample estimation strategy using 65% of 100:

65% of 100 is 65

Target range: 52 to 71

13. 22% of 179 = 39.38

Keystrokes	ON/C	179	×	22	%
Display	0	179	179	22	39.38

Sample estimation strategy using 20% of 200:

20% is $\frac{1}{5}$, so $200 \div 5 = 40$

Target range: 32 to 49

14. 25% of 215 = 53.75

Keystrokes	ON/C	215	×	25	%
Display	0	215	215	25	53.75

Sample estimation strategy using 25% of 200:

25% is $\frac{1}{4}$, so $200 \div 4 = 50$

Target range: 43 to 65

15. 35% of 148 = 51.8

Keystrokes	ON/C	148	×	35	%
Display	0	148	148	35	51.8

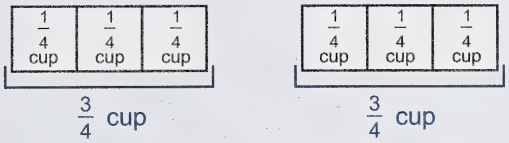
Sample estimation strategy using 33% of 150:

33% is about $\frac{1}{3}$, so $150 \div 3 = 50$

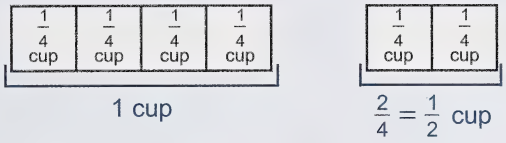
Target range: 45 to 60

Review

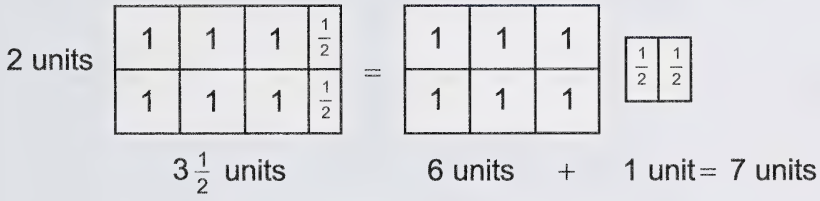
1. a. To double the recipe, $\frac{6}{4}$ teacups of sugar are needed.



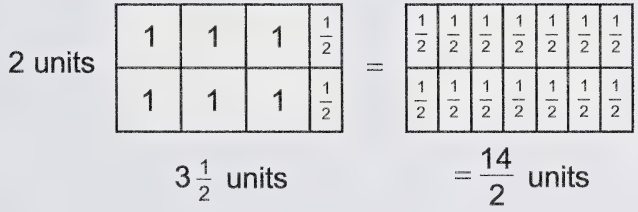
b. To double the recipe, $1\frac{1}{2}$ teacups of sugar are needed. Make as many groups of 4 centicubes as possible:



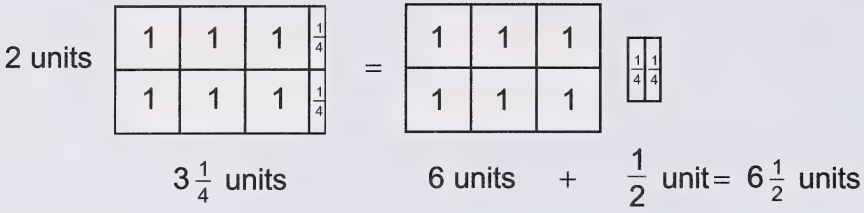
2. a. The area is 7 units.



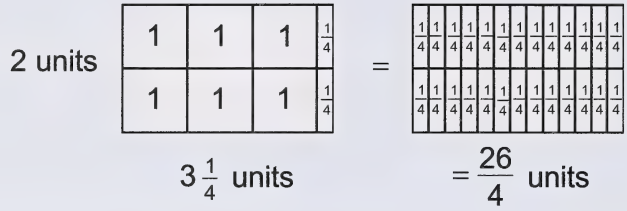
b. The area is $\frac{14}{2}$ units.



3. a. The area is $6\frac{1}{2}$ units.



b. The area is $\frac{26}{4}$ units.



4. The amount of garbage produced in one day is the weekly amount divided by 7.

20 kg per week is $\frac{20}{7}$ kg $= 2\frac{6}{7}$ kg produced in one day

5. a. If the value of the yellow hexagon is 1 whole, then

- the red trapezoid $= \frac{1}{2}$
- the blue rhombus $= \frac{1}{3}$
- the green triangle $= \frac{1}{6}$

b. Instead of using a single yellow hexagon, 1 whole can be made by using any of these seven combinations:

- 2 red trapezoids
- 3 blue rhombuses
- 6 green triangles
- 1 red trapezoid and 3 green triangles
- 1 red trapezoid, 1 blue rhombus, and 1 green triangle
- 2 blue rhombuses and 2 green triangles
- 1 blue rhombus and 4 green triangles

c. Instead of using a single red trapezoid, one-half can be made by using either of these two combinations:

- 3 green triangles
- 1 blue rhombus and 1 green triangle

d. Numerous patterns for $2\frac{1}{2}$ are possible. Four possible patterns are shown.

6. Butter

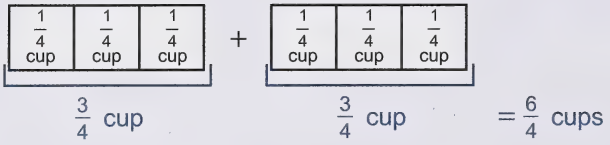
$\boxed{\frac{1}{2}\text{ cup}} + \boxed{\frac{1}{2}\text{ cup}} = \frac{2}{2}\text{ cup}$ $\qquad$ $\boxed{\frac{1}{2}\text{ cup}}\boxed{\frac{1}{2}\text{ cup}} = 1\text{ cup}$

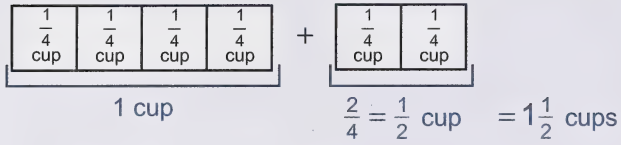
Brown Sugar

$\underbrace{\boxed{\frac{1}{3}\text{ cup}}\boxed{\frac{1}{3}\text{ cup}}}_{\frac{2}{3}\text{ cup}} + \underbrace{\boxed{\frac{1}{3}\text{ cup}}\boxed{\frac{1}{3}\text{ cup}}}_{\frac{2}{3}\text{ cup}} = \frac{4}{3}\text{ cups}$

$\underbrace{\boxed{\frac{1}{3}\text{ cup}}\boxed{\frac{1}{3}\text{ cup}}\boxed{\frac{1}{3}\text{ cup}}}_{1\text{ cup}} + \boxed{\frac{1}{3}\text{ cup}} \quad \frac{1}{3}\text{ cup} = 1\frac{1}{3}\text{ cups}$

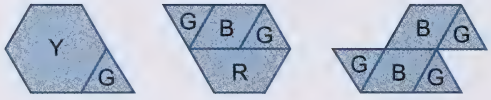
Flour





7. If the value of the blue rhombus is one whole, the value of the yellow hexagon is 3, the value of the red trapezoid is $1\frac{1}{2}$, and the value of the green triangle is $\frac{1}{2}$.

Three possible patterns with a value of $3\frac{1}{2}$ are shown.



8. Textbook, pages 102 and 103, On your Own, questions 1 and 2

1. a. The ratio of orange juice to pineapple juice is 3 to 2 (3:2).

b. The ratio of juice to ginger ale is 5 to 6 (5:6).

c.
- 6:3 describes the ratio of ginger ale to orange juice.
- 2 to 3 describes the ratio of pineapple juice to orange juice.
- 5 to 11 describes the ratio of juice to punch.
- $\frac{5}{6}$ describes the ratio of juice to ginger ale.

2. a. The ratio of green beans to kidney beans is 2 to 1 (2:1). The ratio of kidney beans to lima beans is 1 to 1 (1:1).

b. Answers will vary. Sample answers are given.

Other ratios you can write to describe the salad follow:

- The ratio of green beans to lima beans is 2 to 1 (2:1).
- The ratio of green beans to beans is 2 to 4 (2:4).
- The ratio of kidney beans to green beans and lima beans is 1 to 3 (1:3).
- The ratio of kidney beans to green beans to lima beans is 1 to 2 to 1 (1:2:1).

c. The recipe makes 1 bowl, so to make 8 bowls of salad, you would need the following:

- $8 \times 2 = 16$ cans of green beans
- $8 \times 1 = 8$ cans of kidney beans
- $8 \times 1 = 8$ cans of lima beans

To make 12 bowls, you would need the following:

- $12 \times 2 = 24$ cans of green beans
- $12 \times 1 = 12$ cans of kidney beans
- $12 \times 1 = 12$ cans of lima beans

9. Textbook, page 103, Practise Your Skills, questions 1 to 3

1. The ratio of squares to circles is 3 to 2 (3:2).
The ratio of circles to squares is 2 to 3 (2:3).

2. The ratio of squares to circles is 2 to 5 (2:5).
The ratio of circles to squares is 5 to 2 (5:2).

3. The ratio of squares to circles is 6 to 3 (6:3). You might have simplified to 2:1.
The ratio of circles to squares is 3 to 6 (3:6). You might have simplified to 1:2.

10. Textbook, page 145, Skill Bank Looking Back, question 6

6. a. The ratio of blue to yellow is 3 to 2 (3:2).
b. The ratio of yellow to red is 2 to 4 (2:4). You might have simplified to 1:2.
c. The ratio of red to blue is 4 to 3 (4:3).

11. Textbook, page 175, Skill Bank Looking Back, question 1

1. **a.** The ratio of circles to triangles is 3 to 3 (3:3). You might have simplified to 1:1.
   b. The ratio of circles to triangles is 4 to 2 (4:2). You might have simplified to 2:1.
   c. The ratio of circles to triangles is 4 to 5 (4:5).

12. Textbook, page 105, On Your Own, questions 1 to 4

1. About 30% of the square is shaded.
2. About 60% of the square is shaded.
3. About 90% of the square is shaded.
4. About 75% of the square is shaded.

13. Textbook, page 107, Practise Your Skills, questions 1 to 4

1. 3% of the area is coloured.
2. 24% of the area is coloured.
3. 88% of the area is coloured.
4. 20% of the area is coloured.

14. Textbook, page 115, On Your Own, questions 1 and 2

1. It doesn't make sense.

   - 50% of 10 km is half of 10 km, which is 5 km.
   - Joachim only ran 2 km, which is much shorter than 5 km. In fact, 2 km out of 10 km is like 20 km out of 100 km, which is only 20% of the distance.

2. It makes sense.

   - Karen saved $\frac{3}{4} = 75\%$ of her allowance.
   - She spent $100\% - 75\% = 25\%$.

15. Textbook, page 122, Skill Bank from This Unit, question 4

4.

16. Textbook, pages 132 and 133, On Your Own, questions 1 to 6

1. $\frac{1}{5} = 0.2$ of the students made this statement.

- $\frac{20}{100} = 0.20 = 0.2$ $\qquad 20\% = \frac{20}{100} = \frac{1}{5}$
- 40 students made this statement.

$\frac{1}{5}$ of 200 is $200 \div 5 = 40$, or $\frac{20}{100} = \frac{40}{200}$ is 40:200 = 40 out of 200.

2. $80\% = \frac{80}{100} = \frac{4}{5}$ $\qquad 80\% = \frac{80}{100} = 0.80 = 0.8$

3.
- $40\% = \frac{40}{100} = 0.40 = 0.4$
- 240 students are involved in sports.

$$\frac{40}{100} = \frac{240}{600}$$

4.
- 30% is $\frac{30}{100} = \frac{3}{10}$ of the money you received.
- You should save $15.

$$\frac{3}{10} = \frac{15}{50} \text{ or } \frac{30}{100} = \frac{15}{50}$$

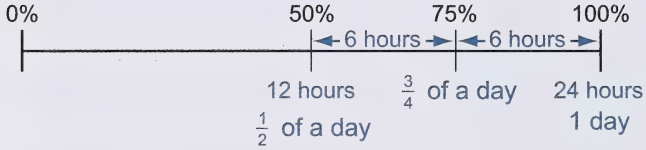
5. a. If the auditorium is 50% full, 200 seats are filled.

- $\frac{50}{100} = \frac{200}{400}$; or 50% full means half full, and $400 \div 2 = 200$.
- $50\% = \frac{50}{100} = 0.50$ or 0.5; and $50\% = \frac{50}{100} = \frac{25}{50} = \frac{5}{10} = \frac{1}{2}$

b. If the auditorium is 70% full, 280 seats are filled.

- $\frac{70}{100} = \frac{280}{400}$
- $70\% = \frac{70}{100} = 0.70$ or 0.7; and $70\% = \frac{70}{100} = \frac{35}{50} = \frac{7}{10}$

6. Sid's cat sleeps for $\frac{3}{4}$ of the day, which is 18 h each day.



- 75% is $\frac{75}{100} = \frac{3}{4}$ of a day $= 12\text{ h} + 6\text{ h} = 18\text{ h}$

17. Textbook, page 144, Skill Bank from This Unit, questions 2 and 3

2. a. $\frac{39}{100}$ is 39%.

b. $\frac{7}{10} = \frac{70}{100}$ is 70%.

c. $\frac{6}{100}$ is 6%.

d. $\frac{1}{2} = \frac{50}{100}$ is 50%.

e. $0.18 = \frac{18}{100}$ is 18%.

f. $0.25 = \frac{25}{100}$ is 25%.

g. $0.06 = \frac{6}{100}$ is 6%.

h. 0.8 is $\frac{8}{10} = \frac{80}{100}$ is 80%.

3. a. $0.25 < \frac{1}{2} < 60\%$

b. $\frac{17}{100} < 38\% < 0.62$

c. $40\% < \frac{4}{5} < 0.99$

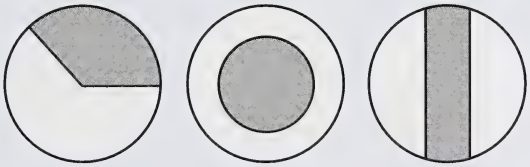
d. $0.20 < \frac{3}{4} < 89\%$

18. Textbook, page 145, Skill Bank Looking Back, questions 7 and 8

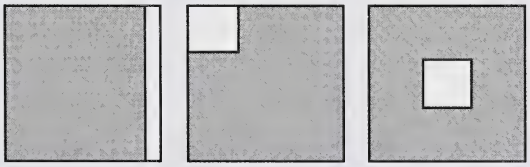
7. Answers will vary. Sample answers are given.

a. About 25% of the square is shaded.

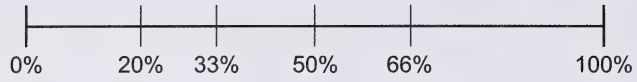
b. About 33% of the circle is shaded.



c. About 90% of the square is shaded.



8.



Note: 20% is $\frac{1}{5}$ of the way between the ends; 33% is about $\frac{1}{3}$ of the way; 50% is $\frac{1}{2}$ way; and 66% is about $\frac{2}{3}$ of the way between the ends.

19. Textbook, page 122, Skill Bank from This Unit, question 2

2. a. 30% of the square is shaded.
b. 90% of the square is shaded.
c. 25% of the square is shaded.

20. Textbook, page 175, Skill Bank Looking Back, questions 3, 4, 6, and 7

3. a. $\frac{1}{4} = \frac{25}{100} = 25\%$ **b.** $\frac{1}{5} = \frac{20}{100} = 20\%$

c. $\frac{4}{5} = \frac{80}{100} = 80\%$ **d.** $\frac{3}{4} = \frac{75}{100} = 75\%$

4. a. $\frac{1}{3}$ is about 33%: $\frac{1}{3} = \frac{33}{99}$, so it is close to $\frac{33}{100} = 0.33\%$.

b. $\frac{2}{3}$ is about 66%: $\frac{2}{3} = \frac{66}{99}$, so it is close to $\frac{66}{100} = 66\%$.

6. a. $\frac{3}{10} = \frac{30}{100} = 30\%$ **b.** $\frac{21}{100} = 21\%$

c. $\frac{1}{4} = \frac{25}{100} = 25\%$ **d.** $\frac{5}{100} = 5\%$

e. $0.24 = \frac{24}{100} = 24\%$ **f.** 0.5 is $\frac{5}{10} = \frac{50}{100} = 50\%$

g. $0.10 = \frac{10}{100} = 10\%$ **h.** $0.93 = \frac{93}{100} = 93\%$

7. Answers may vary. Sample answers are given.

   a. $\frac{45}{100}$, 0.42, 44% are greater than 0.4 and less than 50%.

   b. $\frac{7}{10}$, 0.71, 73% are greater than $\frac{2}{3}$ and less than 75%.

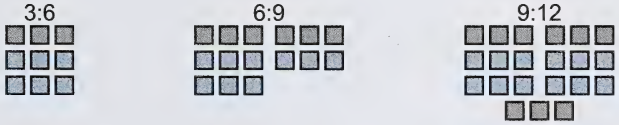
   c. $\frac{34}{100}$, 0.35, 34% (These are less than 0.36 and greater than $\frac{1}{3}$.)

21. Textbook, pages 118 to 121, Problem Bank

1. **a.** The ratio 3:6 describes green cubes to red cubes.
   b. The ratio 2:1 describes red cubes to green cubes.
   c. The ratio 6:9 describes red cubes to all cubes.
   d. The ratio 9:3 describes all cubes to green cubes.

2. **a.** The ratios 5:2, 10:4, and 20:8 are all equivalent.

   b. The ratios 3:6, 6:9, and 9:12 are not equivalent.



4. **a.** Layouts iii and v have about 50% photos.
   b. Layouts ii, iii, and v have about 25% text.
   c. Layout i has more than 75% text.
   d. Layout ii has about 25% text and 50% ads.

7. 50 students received tickets for the game.

$$25\% \text{ is } \frac{25}{100} = \frac{50}{200} \text{ or } 25\% \text{ of } 200 = \frac{1}{4} \text{ of } 200, \text{ and } 200 \div 4 = 50.$$

9.

Measure the line segment to be 10 cm. That means that every 1 cm is 10% of the segment, so mark it off every centimetre.

10. Answers will vary. A sample answer is given.

Percents compare portions to totals. It is possible for a small portion of a big total to be more than a big portion of a small total. For example, if 2 people share a $10 million lottery, each person's 50% share would be $5 million. This is much more than $75 someone else might be given for finding and returning a wallet that had $100 in it, even though it is 75% of the amount returned.

22. Textbook, pages 142 to 143, Problem Bank

1. A 10-by-10 grid is an array of 100 squares (10 columns of 10 squares).

$\frac{9}{10}$ means 9 out of 10, so $\frac{9}{10}$ of the grid is 9 of the 10 columns which have a total of 90 squares.

90% means 90 out of 100, so 90% of the grid would also be 90 squares.

$0.9 = \frac{9}{10}$ because they both mean "nine-tenths."

2. a. $\frac{1}{4}$ of the students has earned a green belt.

$$25\% \text{ is } \frac{25}{100} = \frac{1}{4}.$$

b. $\frac{1}{4} = \frac{25}{100}$ is 0.25.

c. 20 students have earned a green belt.

$$\frac{1}{4} \text{ of } 80 = 80 \div 4 = 20$$

4. a. A penny is $1¢ = \frac{1}{100}$ is 1 % of a dollar.

A nickel is $5¢ = \frac{5}{100}$ is 5% of a dollar.

A dime is $10¢ = \frac{10}{100}$ is 10% of a dollar.

A quarter is $25¢ = \frac{25}{100}$ is 25% of a dollar.

A loonie is $100¢ = \frac{100}{100}$ is 100% of a dollar.

b. A penny is $1¢ = \frac{1}{100}$ of a dollar.

A nickle is $5¢ = \frac{5}{100} = \frac{1}{20}$ of a dollar.

A dime is $10¢ = \frac{10}{100} = \frac{1}{10}$ of a dollar.

A quarter is $25¢ = \frac{25}{100} = \frac{1}{4}$ of a dollar.

A loonie is $100¢ = \frac{100}{100} = 1$ whole dollar.

5. Celine got a better score on the second test.

$\frac{8}{10} = \frac{80}{100}$ is 80% which is less than 85%.

6. a. 8 out of 10 is a better score than 12 out of 20 because $\frac{12 \div 2}{20 \div 2} = \frac{6}{10} < \frac{8}{10}$.

b. 40 out of 50 is a better score than 75% because $\frac{40 \times 2}{50 \times 2} = \frac{80}{100}$ is $80\% > 75\%$.

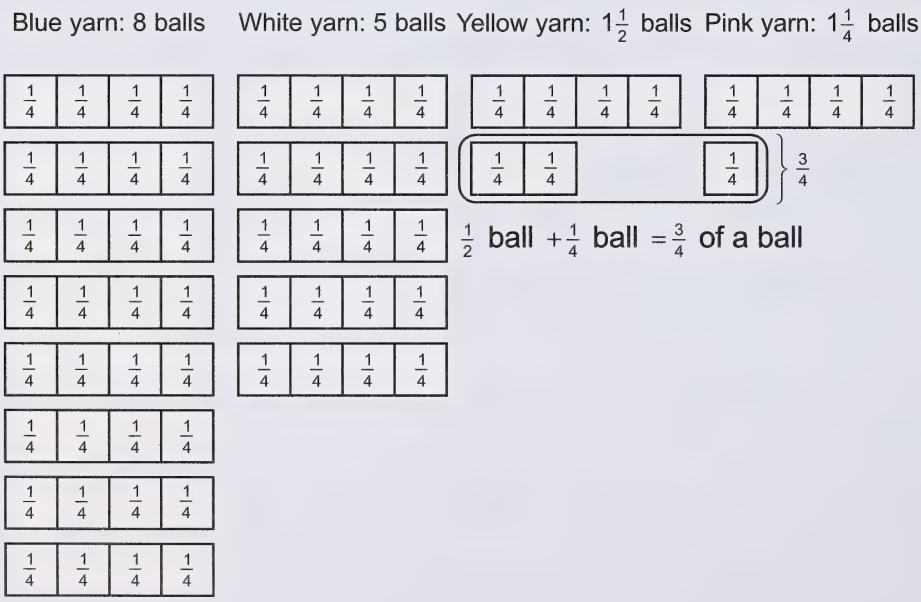
c. 89 out of 100 is a better score than 44 out of 50 because $\frac{44 \times 2}{50 \times 2} = \frac{88}{100} < \frac{89}{100}$.

7. Sarah could have had between 25% and 40% discount.

$\frac{1 \times 25}{4 \times 25} = \frac{25}{100}$ is 25%.

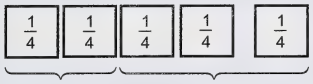
23. Textbook, pages 198 to 201, Problem Bank, questions 1 or 2

1. a. Mark needs $15\frac{3}{4}$ balls of yarn in all.


Blue yarn: 8 balls
White yarn: 5 balls
Yellow yarn: $1\frac{1}{2}$ balls
Pink yarn: $1\frac{1}{4}$ balls
$\frac{3}{4}$
$\frac{1}{2}$ ball + $\frac{1}{4}$ ball = $\frac{3}{4}$ of a ball

b. Mark needs $\frac{3}{4}$ of a ball more of pink yarn.

Pink yarn: $1\frac{1}{4}$ balls $-\frac{1}{2}$ ball $=\frac{3}{4}$ ball

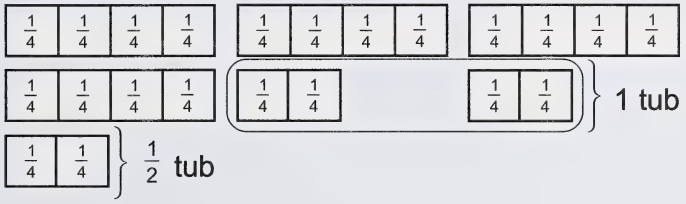


$=1\frac{1}{4}$

$\frac{1}{2}$ of a ball $+\frac{3}{4}$ of a ball $=1\frac{1}{4}$

2. a. They picked $5\frac{1}{2}$ tubs of apples in all.

Terry: $2\frac{1}{2}$ tubs Lisa: $1\frac{1}{2}$ tubs Josh: $1\frac{1}{2}$ tubs



b. $\frac{3}{4}$ of a tub was left.

Apples picked: $1\frac{1}{2}$ tubs $=\frac{6}{4}$ tubs

Used for pie $\frac{3}{4}$ tub

Left over $\frac{3}{4}$ tub

Just the Facts

Multiplication and Division Facts

0	2	10	9	28
5	3	1	32	7
2	3	54	3	0
8	7	5	27	4
36	0	32	6	15

Image Credits

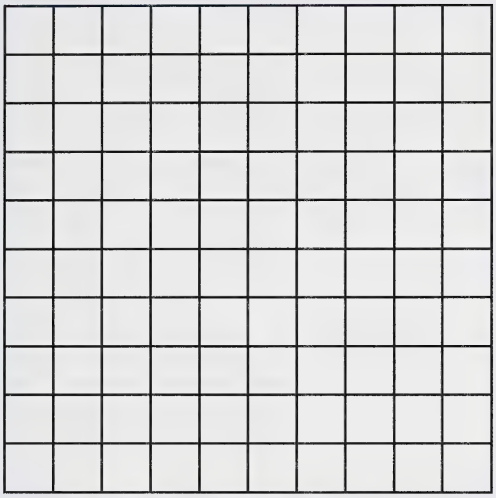
Cover photos (l.-r.): PhotoDisc Collection/Getty Images; PhotoDisc Collection/Getty Images; Corbis; PhotoDisc Collection/Getty Images

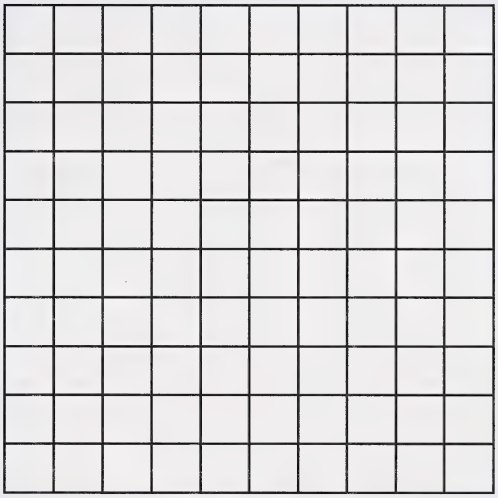
Introductory pages: NASA/ASC (all)

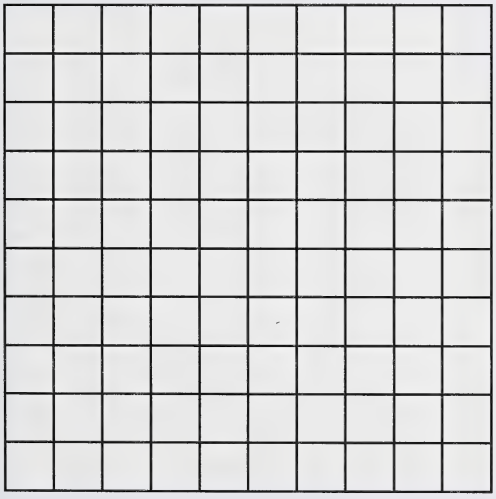
Page
8 EyeWire Collection/Getty Images
10 PhotoDisc Collection/Getty Images (bottom)
12 Corbis
22 © 2001–2002 www.arttoday.com
24 © 2001–2002 www.arttoday.com
30 EyeWire Collection/Getty Images
31 © 2001–2002 www.arttoday.com (bottom)
34 © 2001–2002 www.arttoday.com
36 PhotoDisc Collection/Getty Images
41 © 2001–2002 www.arttoday.com
44 © 2001–2002 www.arttoday.com
45 PhotoDisc Collection/Getty Images
47 Image Club ArtRoom/EyeWire Collection/Getty Images
48 © 2001–2002 www.arttoday.com
49 EyeWire Collection/Getty Images
50 © 2001–2002 www.arttoday.com
51 Image Club ArtRoom/EyeWire Collection/Getty Images
53 Corbis
55 Corbis (view of Earth)
56 PhotoDisc Collection/Getty Images
57 Image Club ArtRoom/EyeWire Collection/Getty Images
66 PhotoDisc Collection/Getty Images
68 Image Club ArtRoom/EyeWire Collection/Getty Images
70 EyeWire Collection/Getty Images
72 PhotoDisc Collection/Getty Images

Learning Aids

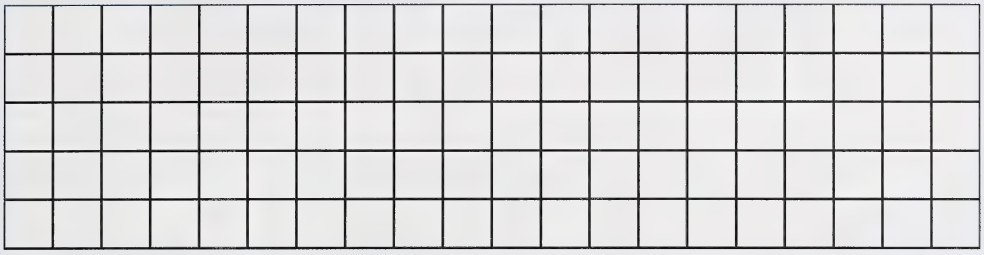
10 x 10 Grids

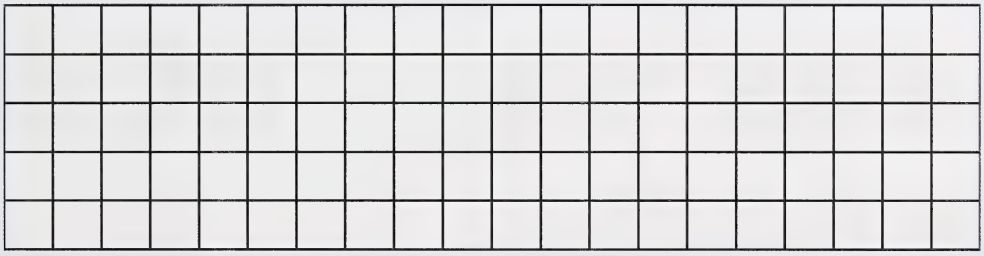




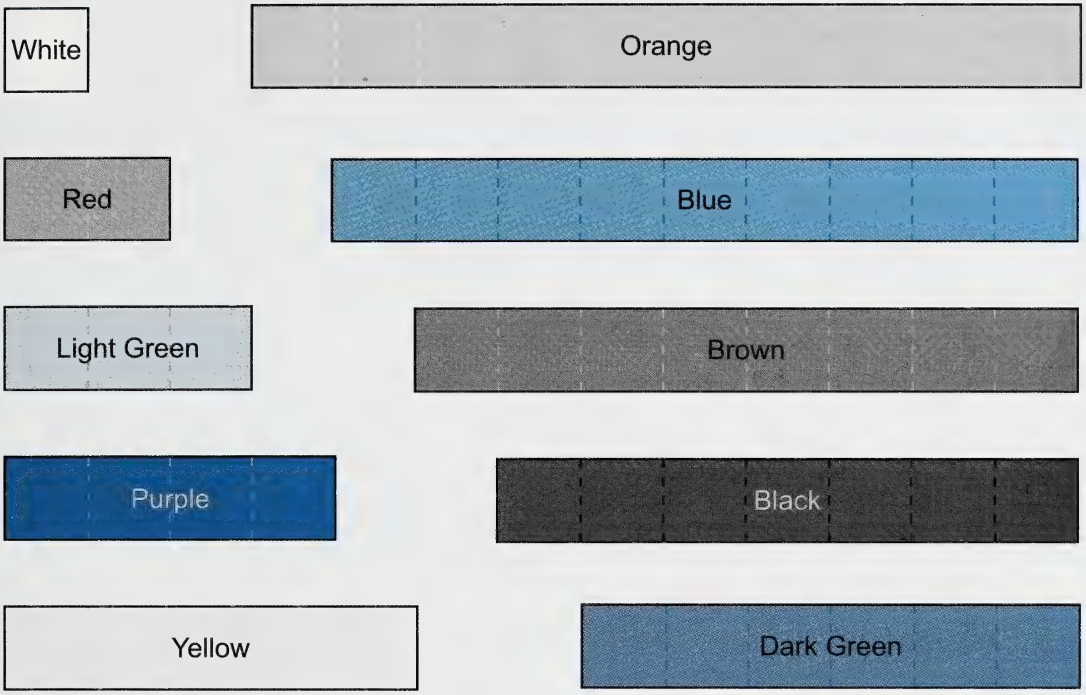


20 x 5 Grids

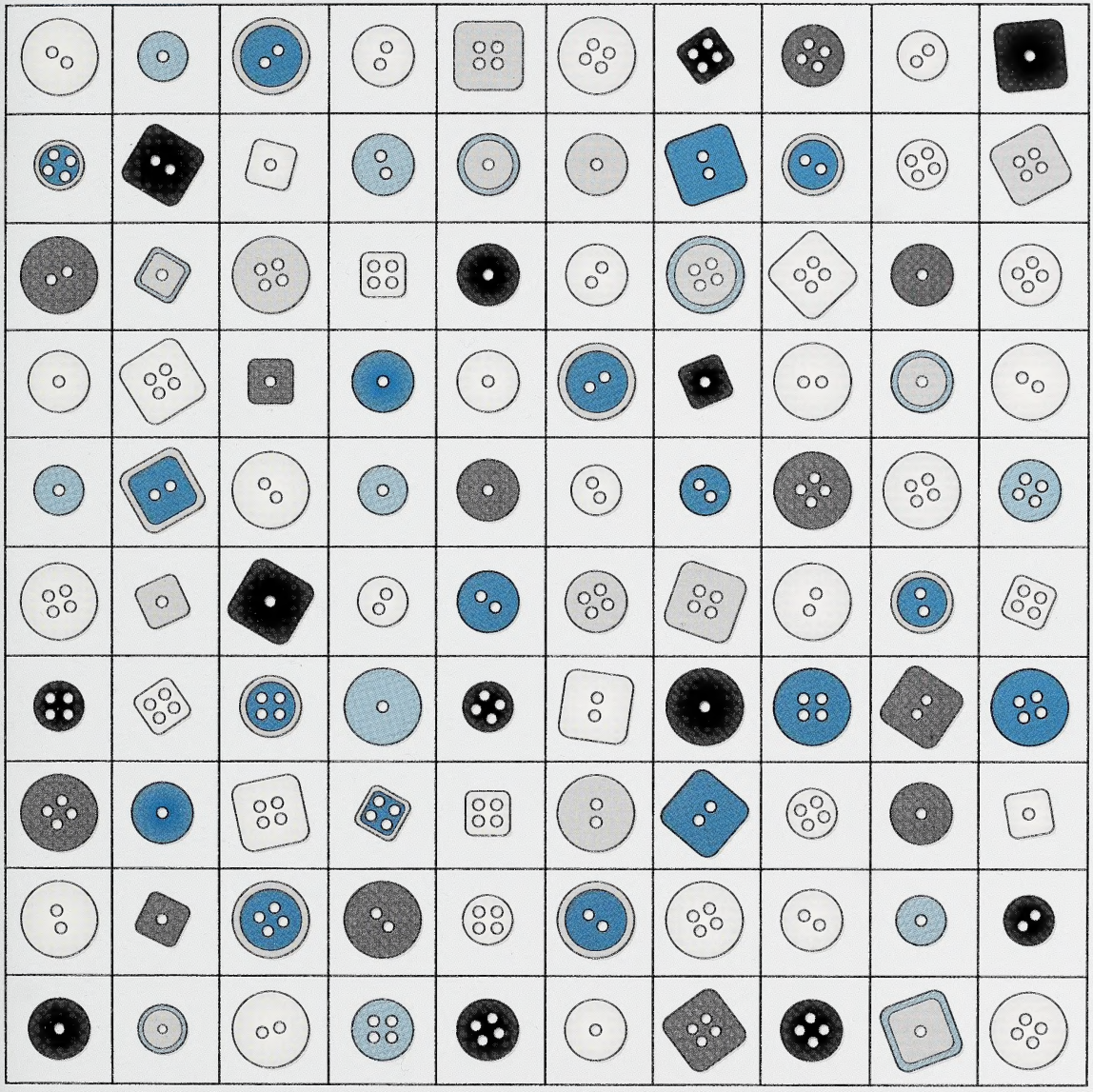


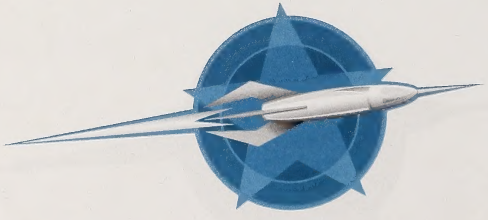


Rods


White
Orange
Red
Blue
Light Green
Brown
Purple
Black
Yellow
Dark Green

Buttons





© 2002